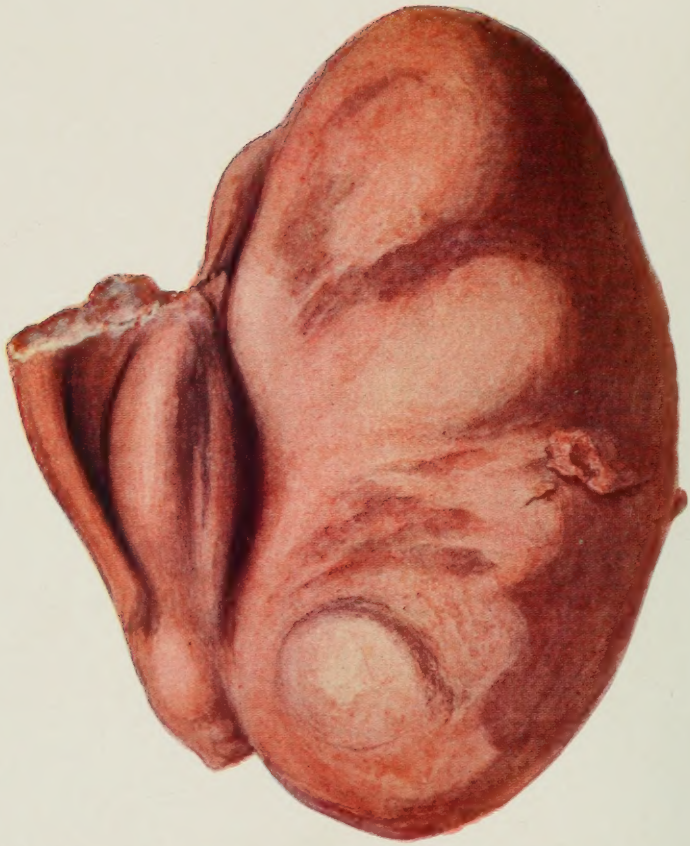

Drawing showing the gross appearance of the sarcoma after removal. The contour is much that of the testicle and epididymis.

INTERNATIONAL CLINICS

A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PEDIATRICS, OBSTETRICS, GYNECOLOGY, ORTHOPÆDICS, PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY, OTOLOGY, RHINOLOGY, LARYNGOLOGY, HYGIENE, AND OTHER TOPICS OF INTEREST TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION
THROUGHOUT THE WORLD

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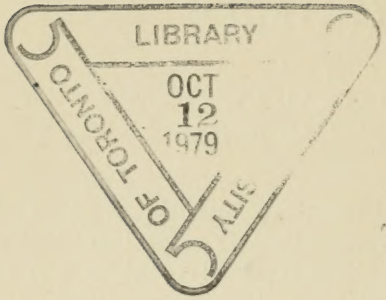

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Treatment

THE TREATMENT OF TETANUS BY INTRA-SPINAL INJECTIONS OF MAGNESIUM SULPHATE, WITH REPORT OF FOUR CASES *

BY JOHN NORMAN HENRY, M.D.

Clinical Professor of Medicine, Woman's Medical College of Pa.; Assistant Physician, Philadelphia Hospital; Physician to Out Patient Department, Pennsylvania Hospital

CASE I—Hospital No. 1226.—S. O., male, aged 9, schoolboy. Admitted July 28, 1907. Discharged August 24, 1907. Diagnosis, Tetanus. Result, cured.

Previous History.—No history of recent external injury. Six weeks ago he was kicked in the back by a horse and the skin was abraded.

Present Illness.—Three days ago he complained of pain in the back, which was followed next day by convulsive spasms without unconsciousness. These affected the whole body.

Physical Examination.—There is rigidity of the patient's jaw, neck, abdomen, and lower extremities. Examination seems to be painful and excites some small shock-like convulsions. Skin is dry and hot. Lungs, heart, liver, and spleen normal. Reflexes exaggerated. Ankle clonus present. Urine, negative.

July 30th—Rigidity increasing. Typical picture of tetanus is present.

July 31st—Condition not so good. Muscles are more rigid. Opisthotonos present. On being disturbed convulsions develop. Lumbar puncture performed at 12.20 P.M., and III c.c. of 25 per cent. Mag. sulph. solution were injected. Fifteen minutes later relaxation commenced, and in one hour it was almost complete, and

* These cases were under the care of the writer while substituting for Dr. Tyson in the wards of the Pennsylvania Hospital.

the patient was drowsy. Pulse and respiration increased. Temperature has fallen a little. Sweating quite freely.

August 1st—Patient still well relaxed and quite clear in intellect.

August 2nd—Rigidity increasing. Condition good. Reflexes are increasing. At 12.20 P.M., lumbar puncture was again performed and III c.c. again injected. The same result followed as in the previous injection with however more marked and rapid effects.

August 3rd—Patient still drowsy and has been sleeping a great deal. Well relaxed. Catheterization necessary.

August 4th—Rigidity very gradually increasing.

August 5th—Became rapidly much more rigid. Lumbar puncture was again performed and III c.c. of the Mag. sulph. solution injected. The results were even more positive than in the previous injections, and the patient at 5 P.M. could scarcely be aroused at all. Respiration became shallow and slow, and condition was somewhat alarming.

August 6th—Temperature again rising. Catheter is necessary to evacuate the bladder. Bowels have been difficult to move throughout illness.

August 8th—Has considerable fever irregular in type, otherwise in good condition. Well relaxed. Urine, negative.

August 12th—Temperature lower. Reflexes have returned. No rigidity present. Bowels more regular.

Blood Examination.—Hæmoglobin, 89 per cent.; leucocytes, 17,000.

Made uninterrupted recovery. Highest temperature, 104.2.

CASE II—No. 1250.—Male, aged 19. Carpenter. Admitted July 30, 1907. Discharged, August 2, 1907. Diagnosis, Tetanus. Result, death.

Family History.—Negative.

Previous History.—Patient injured his foot by stepping on a nail, some seven days before admisson. The foot was quite painful and a physician was called five days after, and the wound was then freely incised and dressed.

Present Illness.—Began last night when the jaws became stiff and this was rapidly followed by stiffness in neck, back, and legs.

On admission the patient is quite rigid, head is retracted and there is a moderate amount of opisthotonos. Has had several clonic spasms. Temperature, 99° on admission. Mind is clear.

Physical Examination.—Is negative as far as heart, lungs, spleen, and liver are concerned. Abdomen is very rigid as are also legs and neck. Opisthotonos is not very marked. Reflexes greatly increased. On ball of left foot there is the mark of a recently healed punctured wound. Weight, 123½ pounds.

Lumbar puncture was performed at 4.15 P.M. and VI c.c. of a 25 per cent. sterile solution of Mag. sulph. were injected into the spinal canal. Ethyl chloride was used as anæsthetic. Fifteen minutes after injection the patient became drowsy and slightly relaxed. One hour later the patient was sleeping and entirely relaxed. Wound of foot was excised.

Temperature rose 1° and pulse rate was diminished 20 beats. Two and one-half hours later the patient is in a deep sleep and is difficult to arouse.

Blood Examination.—Hæmoglobin, 120 per cent.; leucocytes, 22,400.

Urine contains neither albumen nor casts.

July 31st—At 9 A.M. slightly more rigid, head a little retracted.

August 1st—Became as rigid as before the injection, and has slight clonic spasms.

August 2nd—Patient became suddenly worse, and is partially unconscious; respirations are shallow, and pulse is weak, rapid, and thready. Temperature has been steadily rising. Patient died at 5.15 A.M. Temperature at death, $106^{4}/_{5}$.

A rise of temperature followed the intra-spinal injection.

CASE III—Hospital No. 1397.—Male, aged 9, schoolboy. Admitted August 13, 1907. Discharged August 14, 1907. Diagnosis, Tetanus. Result, death.

Family History.—Negative.

Previous History.—Six days prior to admission he stepped on nails with both feet and inflicted puncture wounds.

Present Illness.—Began this morning at 8 A.M. when he developed stiffness and retraction of the neck. At 9 A.M. stiffness and rigidity of the jaws developed. Back, legs, and abdomen became rapidly involved and condition grew very severe.

Brought to the Pennsylvania Hospital in the ambulance. Temperature on admission, 99.3; pulse, 96; respiration, 24.

Physical Examination.—Patient is well developed colored boy, weight 55 pounds. Head is markedly retracted and extremities are rigid. Opisthotonos is pronounced, and clonic convulsions are of very frequent occurrence. Mind is clear. Teeth can be separated but 6 m.m. Pupils are equal and react to light and accommodation.

Lungs.—Chest contains a few moist râles and there is some difficulty in breathing. No areas of consolidation however could be made out.

Heart.—Sounds are clear and regular. No murmurs are present.

Abdomen is very rigid, apparently not tender.

Spleen and liver of normal outline.

Biceps and patella reflexes, markedly increased, ankle clonus present. On the balls of both feet are the marks of recently healed punctured wounds.

Blood Examination.—Hæmoglobin, 97 per cent.; leucocytes, 22,400.

No albumen in urine. Specific gravity, 1037.

Lumbar puncture was performed at 3.30 P.M. and 45 c.c. of a clear spinal fluid withdrawn. Examination of fluid was negative as were also cultures. Two and one-half c.c. of a 25 per cent. sterile solution of magnesium sulphate were injected into the spinal canal. Ethyl chloride was given to the patient, which he took badly, at one time ceasing to breathe altogether. Fifteen minutes after the injection the boy began to relax, and the reflexes were slightly diminished.

One hour later the relaxation was almost complete and the patient became drowsy and then went to sleep. At 6.30 P.M. the temperature dropped to 97.3; pulse, 96; respiration, 28. Patient is completely relaxed, reflexes are gone and he is sleeping deeply. Sensation practically is abolished and the wounds in the feet were excised without giving pain. No tetanus bacilli were found in the excised tissues.

Nine hours after the injection, rigidity and tonic spasms returned as did also the exaggerated reflexes. Temperature rose to 102.3. There are numerous moist râles scattered throughout the chest, more marked at the right base.

August 14th—Condition very grave. Lumbar puncture again performed and 2 c.c. of the magnesium sulphate were injected without however producing much result. The spinal fluid withdrawn was slightly turbid.

The patient grew worse during the afternoon, the chest was full of coarse moist râles and he became comatose and died at 6.55 P.M. No autopsy. Temperature 106° at death.

A rise in temperature followed each injection of magnesium sulphate.

CASE IV—Hospital No. 1514.—Male, aged 45. Teamster. Admitted August 25, 1907. Discharged September 1, 1907. Diagnosis, Tetanus. Result, death.

Family History.—Negative.

Previous History.—Patient stepped on a nail three weeks ago and received a punctured wound. Three days before admission his jaws became stiff. This stiffness lasted until admission when there was slight rigidity of abdomen and some increase in general reflexes.

Physical Examination.—Negative except for the slight trismus already mentioned and the slight rigidity of the abdomen.

Blood Examination.—Hæmoglobin, 99 per cent.; leucocytes, 8,250.

Urine contained no albumen but had numerous hyaline casts.

August 27th—Rigidity increasing and spreading to the back. Lumbar puncture was performed and VI c.c. of 25 per cent. magnesium sulphate solution injected. No anæsthetic was used. On injecting the fluid the patient instantly complained of a burning sensation at the point of entry of the fluid, which sensation almost immediately was conveyed up the spinal column to the base of the skull, and then more gradually spread along the course of the main nerve trunks. The burning pain was sufficiently severe to cause the patient to roll over and cry out for the first 15 minutes. The patient then began to relax, and one hour later became entirely relaxed, very drowsy, and finally slept easily and comfortably.

August 28th—Temperature has risen slightly and there is a small increase in rigidity of jaw and abdomen. Bowels move and urine is voided voluntarily.

August 30th—Patient rigid. Some opisthotonos. Has difficulty in taking either liquids or soft food. Lumbar puncture per-

formed under ethyl chloride and 35 c.c. of clear spinal fluid removed, which was practically negative on microscopic examination. VI c.c. of 25 per cent. solution of magnesium sulphate were injected. Fifteen minutes later patient became relaxed, and one hour later very drowsy, but not totally relaxed. XVIII c.c. of tetanus antitoxin was given subcutaneously.

August 31st—Patient is in a deep sleep from which it is almost impossible to arouse him. He is completely relaxed and reflexes are entirely abolished. Pupils contracted and respond but sluggishly to light. Respirations shallow and irregular. Pulse and temperature are rising. There are also a few râles scattered throughout the chest but no evidence of consolidation. XXX c.c. antitetanic serum were injected into the left buttock.

September 1st—Remained dull and sleepy and in a condition very much like that of a man quite drunk. Later became totally unconscious. Chest was full of moist râles. Died at 6.25 P.M. without any rigidity being present.

Tissue removed from foot did not contain tetanus bacilli.

Temperature, $106^{3}/_{5}$ just prior to death.

This treatment of tetanus, first suggested by Meltzer, has been used in such a small number of cases that it is difficult to judge from the scant literature on the subject just what value it possesses from a curative standpoint. It is unquestionably a most attractive remedy from the symptomatic view point, relieving the patient invariably from tonic and clonic spasm, and permitting him solid and prolonged sleep, a thing altogether unknown in the ordinary acute case.

Meltzer and Auer, in their article on this subject, make but very guarded claims in respect to any curative action of the salt, though their experiments with monkeys—limited in number for various reasons—tend very strongly to show that magnesium sulphate by intra-spinal injection retarded the development of the symptoms of Tetanus and also the fatal result. They found that when too great a quantity of magnesium sulphate was employed, the monkeys became paralyzed in both sensory and motor function and died of central respiratory failure.

The treatment is by no means devoid of danger and the writer has noted in human beings a very strong cumulative action; usually

second injections of the same strength producing much more marked effects than first ones. In one of my cases the patient answered rather mildly to the first and second injections and yet became practically unconscious for nearly 7 hours after a third dose of the same amount as the first and second, given the third day after the second. The first case of the series of 4 here reported recovered, and the enthusiasm for the new treatment was unbounded. The boy became relaxed shortly after the injection, and the following morning was lying comfortably on his back, reading the newspaper, well able to swallow and eat, and, above all things, to sleep comfortably. The case was a severe one yet made an excellent recovery

Case II had but one injection, on the 30th of July, and died on August 2d the usual tetanus death with rising temperature. This patient had the short incubation stage and acute onset which almost invariably indicates from the beginning a fatal termination.

Case III was one of the most acute and severe the writer has ever seen, and at no time did we feel that the patient had any chance of living.

Case IV was disappointing as far as curative effect was concerned, and it is very much a question whether the magnesium sulphate did not contribute to the patient's death. The case was a rather mild one—if we may ever speak of Tetanus as mild—of a subacute type. The injections were withheld at first as the jaws and neck alone were involved and the patient fairly comfortable. Two days after admission, however, the rigidity attacked the abdomen and back, and it was deemed advisable to give the patient an injection. To this he responded in a mild way. On the third day after, the injection was repeated because of returning rigidity, and the patient died on the evening of the second day following the last injection, having remained relaxed, dull, and stupid from that time on.

He suffered from bronchorrhœa as did also Case III. Meltzer speaks of this symptom, and is disposed to regard it as a part of the tetanus rather than a result of the magnesium sulphate. In my two cases that suffered from this complication, the drug appeared to produce and aggravate the condition.

This method of treatment holds out great prospects of at least rendering comfortable the unfortunate sufferers from this terrible

disease. If we consider that cases of tetanus die from the combination of toxin and unrest, surely the functional relief to spine and brain afforded by the injection should be meeting squarely one indication at least, and even in severe cases it gives euthanasia in place of a dreadful death. Another side to the treatment is this; if—as Meltzer found in animals—the drug will delay symptoms and postpone death, it is reasonable to hope that during this prolonged period of the disease antitoxin treatment may be more successful than at present.

I would suggest that in second and third injections the dose be lessened, and the strength of the solution be somewhat diminished.

A COMPARISON OF THE VALUE OF ROENTGEN IRRADIATION AND THE ADMINISTRATION OF ARSENIC IN THE TREATMENT OF LEUKÆMIA

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In International Clinics for January, 1906, I published an investigation concerning the effects of Roentgen irradiation upon the blood-forming organs, with especial reference to the treatment of leukæmia. At that time the clinical reports of the success attending the use of Roentgen rays in this disease appeared very promising, a great improvement having been reported in the majority of cases and a number of "cures" affirmed. Nevertheless, based upon my experimental studies, which agreed in the main with those of Heineke, and as the result of the study of autopsy material derived from three cases of leukæmia so treated, two of them having been reported earlier as "cured," I expressed the opinion that the therapeutic application of Roentgen rays to leukæmia and pseudoleukæmia found a pathological basis in the selective destructive action exerted by the rays upon the lymphocytes and myelocytes, their parent cells and the atypical white cells derived from them. The improvement noted in the majority of cases so treated was, therefore, to be explained by the destruction of white cells and their removal from the general circulation and from the spleen and other tissues where they collect, and, further by a delayed production of new cells.

While thus admitting the possibility of a symptomatic improvement or even a "symptomatic cure," I considered an actual cure as extremely doubtful, and expressed the belief that the leukæmic process was simply resolved into an aleukæmic form, but was not checked or essentially altered. At the same time the dangers of the treatment were noted, and a warning was given against the possibility of an intoxication of proteid origin arising from the disintegration of great numbers of cells, and the involvement of the

nervous system and kidneys. In the final paragraph of my conclusions the statement is made that based upon the pathological studies the therapeutic use of Roentgen rays in leukæmia seemed to be of doubtful value or even dangerous.

Two years have elapsed since the publication of the above opinion and the clinical results of the cases treated by this method up to the present time have in every way supported its main points.

An analysis of over two hundred cases of leukæmia treated by Roentgen irradiation during the period from the first cases reported by Pusey (1902), Senn (1903), and Brown, Bryant and Crane (1904) has been made. The majority of these cases were taken from the literature, while the remainder represent unpublished cases of which the writer has had personal knowledge. Whenever it could be done, the after-history of the case was obtained, either through second publications or through personal communication. It was not possible, however, to obtain later information of some of the cases first reported as cured or greatly improved, except from the general statements made by a number of writers who have collected statistics regarding this point (Dock, Krause, De la Camp, Schirmer, Cramer, etc.). Use has, therefore, been made of such statistics in the conclusions here drawn.

From the clinical work, representing nearly five years of application of this method of treatment, it appears justifiable to make certain generalizations concerning the results obtained, and to arrive at some definite conception of the value of the method. In this brief paper I shall call attention to what seems to be its actual status as compared with the other therapeutic measures at present applied to leukæmia. Briefly stated, this is as follows:

1.—*No positive proof of an absolute cure of leukæmia by Roentgen irradiation exists at the present time.* The cases first reported as cures sooner or later showed recurrence, went the usual down-hill course, or showed a rather striking tendency to die suddenly after a short period of symptoms suggesting severe intoxication.

2.—*A symptomatic cure occurs with remarkable frequency.* In cases of myelæmia the spleen may become greatly reduced in size, the white-cell count may be brought back to normal, the erythrocyte count increased and the color-index raised. The relative proportion

of the different forms of white cells likewise, appears in some cases to be restored to normal; but on this point such positive statements cannot be made, as thorough studies of the blood were not always carried out. But the fact remains that myelocytes and atypical white-cells may be quickly reduced from high proportions to such low ones that, on ordinary examination, the proportionate blood-count seems to be normal. The general condition of the patient in the majority of cases seems to be improved.

Lymphatic leukæmia responds much more slowly than the myelæmic form; but in many cases the white cell count is reduced, the spleen and the lymph glands become smaller, the red cell count and color index raised, and the general condition of the patient improved. The relative proportion of the white cells does not appear to be greatly affected. Only in a few cases is the proportion brought back to normal. In one case, seen by the writer, showing 50 per cent. of atypical large lymphocytes a limited number of treatments brought the proportion back approximately to the normal. in another case the proportion of the small lymphocytes steadily rose under the treatment. On the whole less definite statements can be made regarding lymphæmia, as the statements in the literature do not show such a similarity of results in the treatment of this form as in that of myelæmia.

3.—*Not all cases respond to the treatment, even after extended irradiation.* Cases of myelæmia with symptoms of pain in the bones or with enlargement of the lymph glands offer a greater resistance to the action of the rays, or do not respond at all. Exceptional cases without these symptoms may also fail to react in spite of protracted treatment.

4.—*The earlier in the course of the disease the irradiation is begun, the more pronounced is the reaction of improvement.*

5.—In but a few cases did the treatment, itself, appear to have at once an *unfavorable influence,* exacerbation of the symptoms, evidences of intoxication or even sudden death occurring. As such symptoms or termination may occur in untreated cases of leukæmia they cannot be positively ascribed to the treatment.

6.—Certain *dangers* attend the use of Roentgen rays in general that may be avoided by proper management. The local changes in the skin and the effects upon the genital glands can be averted by

correct technique. As to *specific dangers* attending the use of Roentgen irradiation in leukæmia three possibilities, at least, are to be considered: I. Intoxication from the sudden liberation of disintegration-products of proteid matter. The evidence in favor of this is partly experimental and partly clinical. II. Damage to the kidney apparently results from prolonged treatment of leukæmic patients by Roentgen rays. In the autopsy material of five cases that had been so treated the writer found marked kidney changes (atrophy, necrosis, degeneration, calcification) that do not occur in cases of leukæmia untreated by the rays. It seems safe, therefore, to assume that they stand in relationship to the treatment. III. In one case *fatal hæmorrhages from the spleen* apparently resulted from prolonged treatment. At autopsy large areas of degeneration and necrosis were found in the spleen with the formation of a large blood clot surrounding the organ, the blood escaping from small ruptured sub-capsular vessels. The slow-formation of the clot was shown by its characteristics, it presenting in part beginning organization.

7.—*Recurrence of symptoms* eventually takes place, and the fatal termination of the disease has in no case been averted. It is apparent, however, that the fatal issue is postponed and many of the patients *have gained an extension of life varying from several months to one or two years.*

Summing up the clinical evidence as it exists at the present time we find that the use of Roentgen irradiation in leukæmia is justified by the fact that to many patients it brings a marked, though temporary improvement of the symptoms and, thereby, prolongs their lives for a definite period of time. Any form of treatment that can accomplish this is certainly worth while and should be given a thorough trial.

A better idea of the absolute value of Roentgen therapy in leukæmia may perhaps be gained by a comparison of its merits with those of the most important therapeutic agent employed in this disease, viz., arsenic. This is the only drug that has been found to have any influence in checking the course of the affection. Its action may be stated briefly, as follows:

1. In a certain number of cases arsenic causes a marked diminution in the number of the white cells in the circulating blood, the

total number sometimes falling below that of normal. The relative proportion is also affected, the myelocytes and atypical white cells being reduced, though rarely is the proportion brought back to normal. The red cell count rises as does also the color index. There is also an improvement in the general condition. The spleen and lymph glands may become smaller.

2. Such improvement is always temporary; sooner or later there is a recurrence with an increasing white cell count, usually going above that noted before the beginning of the treatment. No absolute recovery has even taken place.

3. A fairly large number of cases do not respond to arsenic.

4. In the cases reacting to the treatment, life in all probability is prolonged for a certain length of time.

5. Symptoms suggesting intoxication and leading rapidly to a fatal termination may come on suddenly during the period of improvement resulting from the use of arsenic, even when the number of white cells is still normal.

6. Since the good effects of this treatment can be obtained only by pushing the drug to the limits of tolerance and continuing it indefinitely it follows that the danger of arsenical poisoning must be considered.

The remarkable parallel existing between the action of Roentgen rays and that of arsenic upon the leukæmic organism must depend upon a common property, viz.: a destructive action upon the white cells in the circulating blood and in the tissues where they have collected. That this is actually the case has been demonstrated by observation and experiment. Both agents have a leukolytic action and the improvement in the condition of the leukæmic patient rests wholly, it is very probable, upon the degree of this destructive action. The one of the two agents, then, that can produce the greatest and most permanent leukolysis with the least amount of damage to the organism as a whole becomes, therefore, the more effective and valuable therapeutic agent in so far as symptomatic treatment is concerned. And the clinical experience of the last five years shows that property must be accorded to Roentgen irradiation. From the analysis of the cases it appears:

1.—That a *symptomatic cure* is more frequently brought about by Roentgen irradiation than by arsenic.

2.—That the period of improvement is longer in the case of Roentgen irradiation than with arsenic.

3.—That the reduction in the size of the spleen and lymph glands is much greater in the case of the use of Roentgen rays. Since the changes in these organs are a better index of the progress of the disease than is the condition of the blood, this fact is in itself an exponent of the more marked action of irradiation.

4.—That a longer extension of life is granted to the patient by irradiation than by arsenic treatment, and with the more marked improvement produced by the former he may be enabled to secure a number of months of comparative freedom from symptoms, in this way securing the opportunity which is often desired for "setting his house in order." To men of affairs this respite may be regarded as an incalculable boon.

If we accept the evidence of the clinical experiences so far accumulated Roentgen irradiation certainly appears to be the most effective agent in the *symptomatic* treatment of leukæmia. It has, on the whole, a greater element of risk than is the case with arsenic, but in the hands of a judicious and skilful operator these dangers may be reduced to a minimum. Roentgen irradiation should, therefore, not be condemned for its failure to produce an essential cure, but should be advocated for its symptomatic action.

Perhaps the most striking difference in the action of Roentgen rays and that of arsenic is the prolonged duration of the changes effected by the former. Arsenic must be given continuously and pushed to large doses in order to secure its fullest action; but in the case of Roentgen rays a number of exposures may be given, the treatment then stopped, while the benefits persist or may even increase for a time. This persistence of the reaction due to irradiation has been explained as due to the formation of a leukolysin in the blood serum which leads to continued destruction of the white cells and an inhibition of their formation. As a result of such a continued action it is possible to interrupt the exposures from time to time and thus avoid the local injury of the irradiation.

Inasmuch as the two therapeutic agents, Roentgen rays and arsenic, act alike by causing white cell destruction, and as the continued use of each is attended by some danger, an alternation of the two would seem indicated. This has already been advised by a

number of writers, in whose hands the coincident use of the two agents, with alternation according to indications has produced the most pronounced improvement. The use of the arsenic is particularly advised during the pauses between exposures, and when the red blood cells are found to be diminishing in number.

Conclusion

In this combination exists our best means at the present time of delaying the fatal issue of leukæmia, and for this therapeutic gain we are indebted to the application of Roentgen irradiation to the treatment of this disease. As to the possibility of an actual cure by this method the outlook is not promising, but it may be still too early to say that such would not happen in a case discovered and promptly treated in a very early stage of the disease.

As to the way in which the Roentgen treatment should be carried out, but little need be said here. This should be left in the hands of an expert operator. Only general statements may be made to the effect that all portions of the body of the patient except that to be exposed should be protected. A medium tube should be used, and the individual exposures made as short as possible, and given in periods. Between these periods the arsenic should be pushed. The time elapsing between the periods of exposures should be gradually lengthened. In myelæmia the spleen and the long bones are exposed in succession, the former more frequently. In lymphæmia the regional lymph glands as well as the spleen and bones are irradiated.

In all cases the treatment should be controlled by thorough and systematic examination of the patient's blood. An increasing diminution of the red cells is an indication for pushing the arsenic, while an increase in the number of white cells or a change in the proportion is a signal for renewing the irradiation. Likewise the size of the spleen and lymph glands offers a guide to the treatment. In the case of rapid destruction of the white cells with rapid diminution in the size of the spleen and lymph glands any evidence of a beginning intoxication should be carefully noted and the treatment adapted to the conditions. Further, in all cases actively treated the patient's urine should be carefully examined. Evidences of kidney degeneration should lead to an interruption of the treatment.

THE ETIOLOGY AND TREATMENT OF HÆMOPTYSIS IN PULMONARY TUBERCULOSIS *

BY ALBERT PHILIP FRANCINE, AM., M.D.

The occurrence of hæmorrhage in the course of pulmonary tuberculosis is always an alarming symptom to the patient and a source of anxiety to the physician. Much depends on the source of the hæmorrhage as to its seriousness and as to the effect of treatment. In general, the effect of drugs is but palliative, as we possess no drug which will of itself check the bleeding, particularly if it comes from an eroded vessel of large calibre in a cavity or ulcer.

In the application of the general measures of absolute quiet and cold locally, we possess, I believe, our strongest weapons in combating this dangerous accident. Views as to the efficiency of different drugs vary so from time to time, are influenced so much by new experimental evidence (not always to be credited with too much weight) that drugs exploited as effective a few years ago, and universally used, are to-day discarded for new favorites, with the result that in a really bad pinch we know not where to turn. As a matter of fact, in bad hæmorrhage they are all inadequate, as one would expect from the nature of the lesion; while in less severe cases, under the use of general measures, the bleeding will stop—I had almost said, in spite of medication. The treatment of hæmorrhage for those who have not seen the severer forms appears quite satisfactory, but there are times when drugs seem but straws in the path of a rising tide. Fortunately, the severer forms are not common, while moderate hæmorrhage is readily controlled; and slight bleeding (blood-streaked sputum) is not usually a dangerous nor even a serious symptom, except in the possibility of its being a forerunner of a frank outbreak.

The occurrence of frank hæmorrhage, by which is meant free

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* Read in abstract before the Section on Medicine; Pa. State Med. Soc., Sept., 1907.

bleeding (a half pint or more), may sometimes be prognosticated in advance by the presence of small amounts of blood in the sputum and a sense of constriction, oppression, or tickling in the chest. I have known of patients, subject to hæmorrhage, who could tell in this way in the morning of the day they would have an outbreak. Such symptoms or sensations on the part of sensible patients are worthy of attention; and appropriate treatment should at once be instituted.

Rarely, profuse uncontrollable hæmorrhage in advanced cases, usually from the rupture of an aneurismal dilation of a large vessel traversing the floor of an ulcer or cavity, or a succession of profuse bleedings from this source, will prove rapidly fatal by practically exsanguinating the patient. This is not common and it is impossible to check hæmorrhage of this character.

According to a recent view, the erosion of blood vessels in a cavity or the extension of the tuberculous process, is not the direct cause of bleeding, except in so far as this is the result of acute mixed infection. The mixed infections responsible for attacks of hæmorrhage are usually the pneumococcus, combined with the streptococcus and staphylococcus. A certain number of hæmorrhages follow exposure, mental excitement and overexertion, as walking, riding, playing tennis or heavy lifting; but according to this view hæmorrhage is an infection and is contagious. It occurs epidemically in the tuberculous wards of hospitals following the admission of a case with hæmorrhage or pneumonia, and it follows colds. In reports which are becoming more numerous with closer observation, it seems to occur too frequently in this way to be attributed to mere coincidence. Further, bacteriological examination of the hæmorrhagic blood shows the presence in large numbers of these pathogenic bacteria, particularly the pneumococcus.[1]

The exciting cause of hæmorrhage is often mental excitement or physical exertion, and it may arise in this way in vessels already exposed, from rise in blood pressure distending and snapping an aneurismal dilatation of a pulmonary vessel. There has, however, in such cases, always been mixed infection and destruction of tissue

[1] The Pneumococcus as a Factor in Hæmorrhage, *Med. News*, Sept., 1895, and subsequent report.

in the past. It is probably due more frequently than is supposed to an acute infection with the pneumococcus and pus-producing bacteria, which by setting up an active congestion and inflammation, lead to the rupture of the diseased and fragile vessels. Both causes may operate in harmony, the mixed infection acting as a predisposing factor, rendering slight exertion responsible for rupture, which would not otherwise be sufficient to cause it.

Free hæmorrhage does not occur when there is no cavitation or no rupture of vessels. The tuberculous process is a constructive rather than a destructive process, so long as it is uncomplicated by mixed infection. It tends to cicatrization, fibroid change and thrombosis. It is the mixed infections which bring about destruction of tissue with ulceration or cavity formation. Thus we must surely look upon hæmorrhage as evidence of pneumococcic and pus infection, either at some previous period by which cavities have been already formed and the vessels exposed and weakened, or at the time of the hæmorrhage producing rupture by their acute inflammatory action.

There must always be rupture of vessels to have frank hæmorrhage, but this rupture may be very minute and quite general in the congested area. The whole fabric is, as it were, rotten and permeable. No gross rupture of larger vessels may be discoverable at autopsy, but the smaller vessels and capillaries are engorged, dilated and relaxed. All have taken part in the bleeding, and their walls are the seat of numerous impalpable ruptures. They have become in other words, freely permeable from the inflammation, congestion and vasomotor relaxation.

In this connection, chronic inflammation of the naso-pharynx may be an important factor in the occurrence and recurrence of hæmorrhage, as by harboring the pathogenic bacteria of mixed infection, it furnishes the ever present source for infection of the lung, the natural resistance of which has been reduced by the tuberculous process. In the treatment of tuberculosis, therefore, care of the naso-pharynx, not only following hæmorrhage, in preventing recurrence, but also in preventing the occurrence of hæmorrhage, becomes important. Chronic inflammation or congestion of the pharynx and tonsils, chronic inflammation or obstruction in the nasal passages, a deflected septum, should receive appropriate and continued

treatment. Inflammation of the naso-pharynx more or less chronic, more or less severe, nearly always accompanies pulmonary tuberculosis; and the condition of the naso-pharynx should be improved to the normal. This is nearly always possible and is most essential in the prevention of the constant danger of mixed infection arising from this source.

It should be borne in mind that except in the severer hæmorrhages from large eroded vessels (which are not common, but which when they do occur are often fatal), the loss of blood is not in itself the dangerous or even serious feature of the attack. The danger of hæmorrhage, as a rule, lies not in the loss of blood (which is quickly repaired by the organism), but in the lighting up and extension of the tuberculous process. Even small oozings and the consequent contamination of adjacent lung tissue by the infected blood may and often do lead to the extension of the disease downward into previously healthy lung tissue, or the lighting up of a chronic process. Further, the presence of the dead blood in the tissues furnishes a fertile soil for the growth of pathogenic bacteria and the development of a septic pneumonia. The retained clots act as favorable culture media for the growth of the pneumococci, streptococci and staphylococci, and the more dead blood and the more pathogenic bacteria locked up together in the lung tissue, the worse it is for the patient. This in itself is a strong argument against the use of morphine, or drugs similar in action, which, aside from the depressing general effect, lock up dead blood and secretions in the lung, and by so doing directly increase the danger of extension of the tuberculous process, or the development of a septic pneumonia. It follows that the coughing up of redundant blood clots is a favorable feature following hæmorrhage, as in this way the danger of infection and extension is materially reduced. Sometimes small hæmorrhages or the spitting of blood, which result from diapedesis from hyperæmic vessels, is followed by a sense of relief on the part of the patient and is not without benefit in reducing local congestion. While this may be a source of alarm to the patient, yet such cases seem as a rule to do well.

Views on the best method of controlling pulmonary hæmorrhage have, so far as drugs are concerned, undergone a change, and the attempt to control bleeding by the so-called styptics has been largely

given up for physiological and practical reasons. It is now hardly considered good practice to attempt to constrict the pulmonary vessels and capillaries, granting that certain drugs have this action, because they increase the general blood pressure, and induce a reactionary pulmonary hyperæmia, which predisposes to fresh hæmorrhage. In general it may be said that the principles involved are to reduce the rate of the blood current, to increase the coagulability of the blood, and to lower blood pressure—all with a view to inducing clot formation at the local point of bleeding.

It seems very doubtful if any of the drugs formerly advocated in hæmoptysis, like oil of erigeron, turpentine, gallic and tannic acid, lead acetate, sesquichloride of iron, ergot, and the rest, are of any service. The late Austin Flint said many years ago: "After a pretty large experience with these remedies, I find it difficult to form any positive opinion as to their value. They often seem to have no effect as hæmostatics, and when hæmorrhage ceases under their use, there is always room for the supposition that the cessation is due to an intrinsic tendency thereto, rather than to these remedies." This view has been widely confirmed since, until now they have been practically discarded in this connection.

The drugs which are at present receiving most attention for the control of pulmonary hæmorrhage and which seem on physiological grounds to be most available are the nitrites. In the treatment of hæmorrhage from the lungs nitroglycerin, amyl, and sodium nitrite have been found, by those who have used them most, to act quickly and powerfully. My own practice, following that of others, has been to give one minim of the official spiritus glycerilis nitratis, immediately on the occurrence of hæmorrhage, and to repeat this dose at hourly intervals, or oftener in severer cases, until its effect on the circulation was noted or the bleeding had ceased. In severe hæmorrhage I have given this dose every half hour for four or five doses, in association with general measures to be outlined below.

It will not do to prescribe the above and then leave the patient. When giving nitroglycerin in the dosage recommended, it is necessary to keep a strict watch. One gives it with the definite purpose of reducing blood pressure, and is not satisfied until this result is attained. Its action is fugacious and not cumulative, so that it must be repeated frequently, the intervals between doses being gradually

lengthened to two and three hours, until finally after the cessation of the bleeding, it may be reduced to one minim four times a day.

Amyl nitrite has been strongly recommended by Francis Hare,[2] Lawrason Brown,[3] and other competent observers of wide experience. It is given by inhalation in five or ten minim doses, and may be repeated. Brown suggests that amyl nitrite should be given at the onset of hæmorrhage, on account of its instantaneous action, and should be followed by nitroglycerin, or sodium nitrite, and finally within a short period (half an hour) by erythrol tetranitrate. The principle of this lies in the fact that amyl nitrite acts vigorously but is very fugacious; while nitroglycerin and sodium nitrite are slower but more lasting in their effect, the latter more so than the former, and that finally erythrol tetranitrate acts much more slowly but more permanently than the others. He believes in the necessity of lowering blood pressure, but calls attention to the danger of lowering it too much. With the idea of controlling his dosage, he takes the blood pressure every two hours and uses the nitrites accordingly, attempting to keep the pressure between 100 and 115 or 120 mm. of mercury.

It is claimed by Soulier, Pic, and Petitjean, from their experiments on dogs,[4] that nitrite of amyl causes a vaso-dilation of the systemic periphery with secondary and pronounced anæmia of lung tissue from fall of blood pressure, and that there is also manifest a synchronous vaso-constriction of the pulmonary vessels. Hare says that its employment rests on the physiological ground that:—(1) one essential factor in pulmonary hæmorrhage is the existence at the bleeding point of a certain intravascular pressure; that, (2) this intravascular pressure may be reduced passively "by a fall of pressure in the left auricle due to diminished resistance in the aortic outflow" (Shäfer); and that, (3) the resistance in the aortic outflow may be precipitately diminished through the promotion of widespread vaso-dilation of the systemic periphery by inhalations of amyl nitrite.

[2] F. Hare. *British Journal of Tuberculosis.* Jan., 1907.

[3] L. Brown. *Trans. Nat'l. Assoc.* 2nd An. Report. See also Rouget, *Societe Med. des Hospitaux de Paris.* April 20, 1905. A. C. Colman. *Scottish Med. & Surg. Journal.* May, 1905. Bourland. *Traitement des Hemoptysies par le nitrite d'amyl.* Lyon, 1905.

[4] Quoted by F. Hare, Ibid.

Grace-Calvert[5] says that by the great reduction in the general blood pressure, the pressure at the bleeding point is lowered to such an extent as to give time for clot formation; and instances among the advantages of the use of amyl nitrite the fact that there is no reactionary pulmonary hyperæmia, as is apparently the case with adrenalin; and that it does not lock up the secretions and prevent the coughing up of the effused blood, as is the case with morphine.

From experimental evidence the calcium salts are practically the only drugs (with the possible exception of magnesium carbonate and gelatine), and certainly the best drugs, to increase the coagulability of the blood. For this reason I am very much in favor of using the chloride or lactate of calcium where the occurrence of hæmorrhage is to be feared, and following the occurrence of hæmorrhage. Calcium is a valuable adjunct to other measures in the treatment of hæmorrhage, but should not be continued longer than three or four days at a time, as its continued use is claimed (Wright) to reduce the time of clot formation. It may be given in water, five grains to the dram, as follows:

Calcii chloridi, ʒii;
Aquæ puræ, fʒiii.
Sig.—Two teaspoonfuls every hour.

Wright and Paramore[6] advise sixty grains, in doses of twenty grains each at equal intervals, three times a day. Calcium may also be given hypodermically, the lactate being used as it is more soluble (1 to 10 parts of water) and does not produce the local irritation of the chloride.

Calcium chloride is active in increasing the coagulability of the blood within an hour from the time of its administration, while the lactate shows its effect within 20 minutes (Wright).

Gelatine may be prescribed in the form of jelly three times a day. It soon becomes very unpalatable however. It may also be given hypodermically, following the formula of Lanceraux and Paulesco, as follows:

Gelatini,
Sodii chloridi, āā gr. cl. (10.0 c.c.);
Aquæ distillatæ, Oii (1000 c.c.).

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[5] *Lancet*, clxxii, 4362.

[6] Quoted by H. A. Hare, *Therapeutic Gazette*, Jan. 15, 1906.

This mixture is sterilized by heat and two ounces (60 c.c.) are injected into the tissues of the thigh or buttock. This may be increased to five ounces (150 c.c.) in later injections. The gelatine should be boiled at least an hour, as tetanus spores may be present and are only killed with considerable difficulty.

With a view to further increasing the coagulability of the blood, it is important to get the bowels freely opened, provided the patient's condition will warrant it. This measure, however, should be applied with judgment, as it will not do to purge a patient who is on the verge of collapse or very weak. But in those cases where there is constipation with a pulse of good volume and good tension, and certainly where there is hypertension, it is a useful measure. For this purpose magnesium sulphate in half drachm or drachm doses should be given in a little water every hour until the bowels are freely moved. A bed-pan should always be used.

It is interesting to note that the use of magnesium sulphate has probably a distinct influence in increasing the coagulability of the blood, aside from the depletion of the system. Wright and Paramore have shown that magnesium has a very active influence in this direction, only second to the calcium salts. As all the salts and bases of magnesium are converted to the acid carbonate in the small intestine (Dixon[7]), it seems certain that the sulphate must share, though probably to a less extent than the carbonate, this power.

Only in very alarming hæmorrhage would I advocate the continued use of morphine. An initial dose of ¼ grain of morphine and $^1/_{150}$ of atropine hypodermically is always permissible to quiet the patient. Morphine in small and frequently repeated doses will sometimes control hæmorrhage, which fails to respond to other measures. It may be given in ⅛ or ¼ gr. doses every hour up to a point where there is danger of narcotizing the patient. I have avoided its use in very bad cases with gratifying results however, and it is doubtful if there is much advantage in stopping hæmorrhage in this way, as the effect of the morphine is very unfavorable both on the local process and general condition of the patient. Where the patient is nervous and restless and needs a sedative, I would greatly prefer sodium bromide in five grain hourly doses, combined if need be, to counteract its depressing effect with

[7] *Pharmacology*, London, 1906.

a few minims of aromatic spirits of ammonia, as in the following prescription:

Spiritus glycerilis nitratis, M. xxiv;
Spiritus ammoniæ aromaticus, f℥iv;
Sodii bromidi, ℥ii;
Aquæ cinnamonis, f℥iii.
Sig.—Teaspoonful every hour for five doses.

The group of drugs derived from the suprarenal bodies must be mentioned. There seems, on theoretical grounds, to be some question of the availability of these drugs in hæmoptysis, but clinical and experimental evidence on the whole seems to endorse them under certain circumstances. Their best influence unquestionably is exerted when they can be applied locally, but there seems good ground to believe that they influence favorably internal hæmorrhage. The objection to their use on the score that they produce arterio sclerosis is not very valid in this connection, as they should not be kept up longer than a few days to a week.

Of this group of drugs, I prefer adrenalin chloride, and believe that I have seen it influence bad hæmoptysis favorably. Certainly in those cases where nitroglycerin is not indicated, or where it has failed of effect, in the absence of circulatory hypertension, I would not hesitate to prescribe it. It may be given in doses of $^1/_{50}$ to $^1/_{20}$ of a grain, intravenously or hypodermically. There is danger when exhibited in the latter manner of producing a slough, so that the former method seems preferable. If given by the mouth, the pure solution as sold in sealed ounce bottles (Parke, Davis & Co.) should be used, in which half a drachm equals approximately a thirtieth of a grain. This dose should be given in a little water, and following severe hæmorrhage I have used it every hour for five or six doses, and then lengthened the intervals to two or three hours. Used in this way it seems to exert an appreciable effect on the bleeding. In less severe hæmorrhage it may be given three or four times a day in the above dose. It is claimed by the therapeutists that adrenalin chloride is decomposed by the acid of the gastric juice, and that it is also less effective when injected into the tissues than when thrown directly into the circulation.

But in connection with the use of drugs to control hæmoptysis, it must be admitted that it is very difficult clinically to estimate their

value. Improvement or the reverse, often coincidental in these cases, will inevitably color the clinician's views in regard to the drugs being used. It is therefore a satisfaction to close with the general measures to be followed and which are in my mind more important than drugs.

When a patient begins to bleed in tuberculosis, be it much or little, he should be put to bed. This is not understood to apply to blood-streaked sputum,—in this circumstance it may be sufficient to confine him to a reclining chair, provided his temperature (not above 99½) warrants his being out of bed. The patient should be put at absolute rest on the flat of his back, with his head supported by one or two pillows as he prefers. Talking must be forbidden. No warm drinks, alcoholic nor otherwise, and no solid foods are permitted. Cracked ice in small amounts may be given to suck. An ice-bag should be put over the præcordium and another over the source of the hæmorrhage. If there is much pneumonic consolidation, a flat, suitably shaped ice-bag should be placed under the affected lobe as the congestion is apt to be more marked or to extend posteriorly. Ice-bags should be thoroughly dried and wrapped in a towel or piece of flannel. If there is much anxiety or restlessness on the part of the patient, a single dose of a quarter of a grain of morphine and a hundred and fiftieth of atropine is permissible,—to be followed if necessary by five-grain hourly doses of sodium bromide. The physician's manner should be calm and reassuring, whatever misgivings he may cherish; and he should reassure the patient on the score of loss of blood. The idea of spitting up "their life blood" is naturally contemplated with terror by even the stoutest hearted. Where possible, morphine should not be used. Inhalations of amyl nitrite, and nitroglycerin by the mouth should at once be begun, if the state of the circulation warrants it, and kept up until their effect on the pulse is apparent, or their physiological action is complained of by the patient, when they should be cut down to two and then three hour periods. Calcium lactate should be given hypodermically (or by the mouth) and repeated; while the bowels should be freely opened by magnesium sulphate—unless the contraindication exists in weakness.

Where the pulse is weak and the heart's action irregular or unsatisfactory, and there seems to be general relaxation of the

arterial system, digitalis may be given in addition to nitroglycerin or in place of it. Unless a strong cardiac stimulant is distinctly called for, however, it is better to rely on a diffusible stimulant like aromatic spirits of ammonia, in small doses every hour, or strychnia gr. 1–30 every three or four hours, for general stimulation.

If there is evidence in the lung of congestion associated with blood-streaked sputum, dry or wet cups should be applied over the area of congestion. At first in front, and as soon as the patient can be moved with safety to the back. Two dry cups in the morning and the same in the afternoon are sufficient; or an ounce, to an ounce and a half, of blood should be withdrawn by wet cups. In bad hæmorrhage, dry cups applied to the chest anteriorly and posteriorly were much used by the older practitioners with the idea of withdrawing blood from the general circulation and relieving local congestion.

Strapping the chest on the affected side is of service in limiting motion. The circulation in the extremities may be temporarily cut off for fifteen or twenty minutes by ligatures applied to legs and arms or by bandaging the extremities. This detains the blood in the veins beyond the ligatures and secures the effect of venesection; or, as suggested by Austin Flint, loose ligatures may be applied to the four extremities, and tightened when the hæmorrhage recurs. Hot water bottles, hypodermoclysis, and other measures of stimulation must be resorted to when the danger of collapse is imminent, in the hope that by prolonging the heart's action a clot will form. This sometimes takes place in very grave bleedings, apparently from the very reduction in volume and slowing of the blood current.

Absolute rest, with ice locally and the use of nitroglycerin, should be kept up following the bleeding, until the signs of acute pneumonic infiltration have disappeared, if these be present. The ice-bags may then be dispensed with and the nitroglycerin cut down to three or four doses a day. Following a bad hæmorrhage the patient should be fed only on milk and eggs. Two glasses of milk and three eggs, given at three hour intervals through the day, beginning at 7 A.M., is sufficient for a few days, following which the diet may be systematically increased.

Incidentally it may be mentioned that cows' milk in large quan-

tity has according to Wright a very appreciable effect in increasing the coagulability of the blood and reducing the time required for clot formation.

After the arrest of free hæmorrhage the patient should be kept in bed at least ten days or two weeks, if afebrile, in order to allow sufficient time for resolution of the pneumonic process and organization of the clot. If there is fever he should be confined to bed until it remains consistently at or below ninety-nine and a half. Following the period in bed, he should be restricted to a reclining chair, and should only begin to go about with the utmost precaution.

The hæmorrhagic blood should be investigated bacteriologically by animal inoculation and growth on culture media. The blood, if very toxic, inoculated into white mice, will kill them in two to four days, and pneumococci in pure culture can be obtained. Streptococci will also be found, and tubercle bacilli, as a rule, in large numbers. Such examinations should be repeated every week or ten days, and as the patient's condition improves, the virulency of the infection will diminish, but pneumococci may not disappear from the sputum for a long time. And even when they do, there is no guarantee that they may not be dormant in the affected area. Consequently there must be exercised the greatest care in order to guard against exertion and "colds," lest the process at any moment be lighted up and another hæmorrhage result. The sudden outbreak of severe fresh hæmorrhage without apparent cause in a patient apparently doing well is an unpleasant and not unknown occurrence. The spitting up of small clots and blood-streaked sputum will often last ten days, two weeks, or longer, following a frank hæmorrhage. During this time, therefore, the utmost precautions should be taken against even the slightest exposure or slight exertions, as might be involved in careless attempts to wash the patient or change his bed clothes.

During convalescence he should have the strictest attention and treatment of his nose and throat in order to guard against the danger of possible reinfection from this source.

ON THE ACTION OF INJECTIONS OF FRESH BLOOD-SERUM IN BLOOD-STATES THAT GIVE RISE TO HÆMORRHAGE

BY P. EMILE WEIL, M.D.
of Paris

When physiologists had shown that the salts of calcium facilitate blood coagulation, physicians, on the advice of Wright & Carnot, began to prescribe them in conditions attended with hæmorrhage. The method gave excellent results, and is to-day the best, if not only, treatment of dyscrasic hæmorrhage.

But it is a curious thing that although physiologists had in many instances seen blood that could not be coagulated experimentally, regain *in vitro* its power of coagulation by the adjunction of fresh blood-serum, no physician was led to see whether the different sera, had, in the human system, any antihæmorrhagic action similar to that of the calcium salts. This is the question that I have taken in hand, and to which I was led, not by theoretical considerations, but by my researches in connection with hæmophilia (r. International Clinics, series 16, vol. ii, p. 124), in the course of which I had observed that different fresh sera were capable of doing away with all kinds of anomalies of blood-coagulation.

I.

THE EFFECT OF INJECTIONS OF FRESH BLOOD-SERA IN HÆMOPHILIC CONDITIONS

A.—*In spontaneous hæmophilia,* where a serum *in vitro* corrects entirely the different anomalies in blood-coagulation, injections *in vivo* of this serum will have the same result. The patient, whose blood has recovered its normal state, behaves as does a normal individual. One of my patients was able to have a tooth extracted, without any special loss of blood, twenty-five days after an injection of fresh serum; another one was in condition to undergo operation

for empyæma and incision of perinephritic abscess, without unusual loss of blood, two days after having received an injection of twenty c.c. of fresh horse-serum. Consequently, serum has a *preventive action* that manifests itself at the end of forty-eight hours, and that lasts at least twenty-five days.

I have not had an opportunity to test the *curative action* of injections of fresh serum in spontaneous hæmophilia; but there is no question in my mind but that this method of treatment will be efficacious in view of the fact, on the one hand, that such injections completely correct the blood disorder from which these patients suffer, and, on the other, that they prove efficacious in hæmorrhagic conditions where they only attenuate the blood disorder.

B.—In *family hæmophilia* the injections have a manifest *preventive action.* One of my patients, who bled for twelve hours whenever he cut himself shaving, only bled for two minutes under the same circumstances after he had received an injection. This same patient, who was subject to hæmarthrosis about once a month, has had no more attacks for eleven weeks.

The *curative effect* exists to the same degree. Another of my patients found that an attack of hæmaturia that had continued for a month, began to diminish the day after an injection, and disappeared definitely on the third day after it.

In addition to their general action the injections of sera appear to have a local effect. Perthis has published the case of a boy of twelve, suffering from family hæmophilia, with whom bloody oozings from the gums, that had lasted for three weeks, and on which no treatment had any effect, stopped after a local injection of one c.c. of defibrinated rabbit blood.

This therapeutic method has always succeeded, so far, in my hands; but I should not be surprised if this turned out not to be invariably the case, at any rate in the family form of hæmophilia, where the serum injection is not followed by entire correction of the blood disorder. At the present time I am busy with Dr. Paul Carnot in endeavoring to obtain a serum better adapted to correct this disorder, and which, in our opinion, will have greater efficacy.

II.

THE EFFECT OF THE INJECTION OF FRESH BLOOD-SERUM IN PURPURIC CONDITIONS THAT INDUCE HÆMORRHAGE

I have also used injections of fresh serum in acute and chronic, primary and secondary hæmorrhagic conditions, and the results obtained, although not very numerous, are most encouraging.

The disorders of the blood in the serious conditions inducing hæmorrhage are analogous to, though not identical, with those of hæmophilia: in a general way there is, during the hæmorrhage, plasmatic coagulation, retarded coagulation, absence of clot-retraction, and absence of exudation of serum; all of these anomalies decrease *in vitro* when small amounts of fresh serum, or of calcium chloride are added. Intra-venous injection of serum is followed by decrease but not by disappearance of the blood disorder. Here is the substance of the cases I have treated.

First. *Acute Purpura, Primary or Secondary.*—My first case is that of a woman who worked by the day and came to the hospital on September 19, 1905, for febrile polyarthritis. This woman, who had habits of intemperance, presented on entrance a fungous and hæmorrhagic condition of the gums, epistaxis, and a pronounced gastric disturbance. The urine was normal in appearance, and without albumen. On September 23, subconjunctival hæmorrhage appeared, with large purpuric spots on the limbs and violent hæmaturia. All of these symptoms, the pain, inflamed joints, a high fever, lasted until the end of the month. After a slight decrease during two days, the hæmaturia increased, and the urine became black. Examination of venous blood showed disturbed power of coagulation, and an intra-venous injection of 15 c.c. of fresh bovine serum was made. On the next day the temperature fell from 39° C. to 37.4°, and the urine became almost transparent; the gums were no longer fungous and had stopped bleeding; and the pain and joint-symptoms had entirely disappeared. From October 6th to 9th fresh traces of blood appeared in the urine, together with a slight return of fever; but on the 9th all the abnormal phenomena disappeared again, and the patient left the hospital on October 15th, entirely well, though still presenting slight disturbance of blood coagulation.

The second case is that of a young man of nineteen. Three months before admission to the hospital he had an attack of febrile polyarthritis, which gave rise to aortic insufficiency. He was hardly recovered when, on October 20th, he was seized with abdominal pain, together with diarrhœa and fever.

At his entrance into the ward he was found to be very pale, with enlarged liver reaching three fingers below the ribs; his urine was dark red, abundant (4 litres) and contained seven grams of albumen per litre, due to the blood. On November 14th the hæmaturia increased and violent epistaxis set in. The cause of the trouble was not apparent, but the possibility of tuberculous infection was suspected. Blood examination showed a high degree of anæmia (2,912,000), and serious derangement of coagulation (plasmatic coagulation of venous blood in two hours). An intra-venous injection of 10 c.c. of fresh rabbit serum put an end at once to the epistaxis, which did not occur again. The urine decreased, and contained much less blood, though the latter did not disappear altogether; the amount of albumen oscillated between one gram and half a gram per litre. The second injection, given on November 22nd, 15 c.c., was followed by improvement in the patient's general condition; the man, who had become very emaciated, began to put on flesh, but the lesions of the blood, though less marked, continued to manifest themselves (coagulation in fifty-five minutes).

On December 1, 1906, I was called in consultation to see a patient who had had profuse hæmaturia for three days, consisting of almost pure blood. In addition to this the man presented marks of purpura with large ecchymoses, melæna, and fungous and bleeding gums. The patient's temperature was 39° C. This had appeared during the subsidence of an attack of typhoid fever which was complicated, about the thirtieth day, by double pneumonia. Microscopical examination of urine showed innumerable pneumococci in the form of diplococci and chains; the blood was slow to coagulate and the clot did not retract. I injected beneath the skin 30 c.c. of fresh antidiphtheritic serum only two days old; the following day the gums were neither fungous nor bleeding, while the renal hæmorrhage had much diminished. On the second day there was no longer any trace of blood or albumen in the urine, and the temperature was 37.4°.

In a fourth case I injected three days before death 15 c.c. of fresh bovine serum into the veins of a man of fifty, a driver, who entered the hospital on December 20, 1905. There was atrophic cirrhosis of the liver with great ascites, and, for the past three weeks, there had been icterus, epistaxis, hæmatemesis, hæmaturia and purpura. In addition there was a focus of broncho-pneumonia with congestion of pulmonary bases, arrhythmia and tachycardia. The temperature was oscillating around 39° C. After the injection the urine cleared up, and by the second day the blood had entirely disappeared; the hæmatemesis had also ceased. But the fever and icterus continued, the pulmonary and cardiac symptoms did not improve and the patient died in coma, with delirium, convulsive movements and twitching tendons.

In short, in these different cases the injections of blood serum had manifest curative effect: in two cases of acute purpura they were followed, not only by definite cessation of hæmorrhage, but they hastened recovery; in the third the hæmorrhage decreased noticeably; in the last, in spite of the disappearance of hæmorrhage, the patient, stricken with hepatic insufficiency, died as patients die from hæmorrhagic smallpox, through intoxication, even when the loss of blood is checked.

Second. *Chronic Forms of Purpura.*—I have only had occasion to take care of two cases of chronic purpura; one of them I was able to follow very closely, but the other hardly at all, so that I shall scarcely take it into account.

The first one was that of a man of forty-two, butcher, having had habits of intemperance for many years. His digestion was bad, his liver enlarged, and there was articular pain without fever, and purpura of both arms and legs.

During a period of three months this patient had presented a series of ten eruptions of purpura, while his articular pain alternated with abdominal crises. The urine contained blood continuously, and whenever the patient cut himself shaving, he was sure to have prolonged bleeding. By following a suitable diet his condition improved, and he gained twenty-five pounds in weight in six months; still, the purpura would appear at the slightest fatigue, and his urine was always red or reddish.

The patient was then sent to me, and on July 15, 1905, he was

given the first intra-venous injection of bovine serum. The disturbance in coagulation, which was pronounced, decreased. A second injection of 15 c.c. was given on July 22d. When next seen, on September 22d, the patient reported that his urine had never been red since; nor had there been any further purpura or articular pain. The urine then showed a small amount of albumen; his blood-coagulation was subnormal. Another injection was then given of 15 c.c. of fresh human serum. When seen again, in March, 1906, he reported that there had been no further purpura at all, but that his urine was very abundant, and contained a trace of albumen. The following November (the patient having resumed his drinking habits), his liver was found still enlarged; his urine, without sign of blood, was albuminous, although there were no symptoms of Bright's disease. The blood had then regained its normal properties, so that in spite of his desire I did not renew the injection.

The second case of chronic purpura was that of a girl of six, with adenoid growths, who had on several occasions been seized with such violent epistaxis, necessitating plugging of the nasal fossæ, that a physician had been obliged to remain constantly by her side. She presented in addition to this, cutaneous ecchymoses. I saw the patient, called by her physician to administer an injection of serum in order to prevent the recurrence of these attacks; but I had no opportunity of studying the hæmatic alterations. After a subcutaneous injection of bovine serum, which caused quite a lively thermic reaction, the child remained for six months without any farther hæmorrhage. It is difficult, in the absence of hæmatic examination in this case, to decide how much credit should be assigned to the treatment in the improvement that resulted.

Third. *Chronic Purpura and Pernicious Anæmia.*—Just as it is sometimes impossible to make a differential diagnosis between certain forms of chronic purpura and certain cases of spontaneous hæmophilia, so is it equally difficult to separate cases of chronic purpura from those of pernicious anæmia; for there are many transitional forms connecting with each other the hæmatic dyscrasiæ. The mutual relations between the purpuras and anæmias are easy to grasp: the abundant loss of blood in chronic purpura may produce intense anæmia, and this repeated hæmorrhage may entail

secondary insufficiency of the hæmopoietic organs. In this manner pernicious anæmia may follow chronic purpura. In another instance a toxic or infectious cause may produce simultaneously hæmolysis and coagulation disturbances; the loss of blood hastens the decrease in blood corpuscles: the pernicious anæmia and purpura appear simultaneously. According to whether the anæmic condition or the hæmorrhagic predominates, the name given to the disorder will differ; at one time the case will be called chronic purpura, at another pernicious anæmia.

I have had two such cases under treatment. The first was reported to the medical society of the Paris hospitals under the title of pernicious anæmia with remissions. The patient was a girl of fourteen, who after an operation for appendicitis was seized with serious anæmic symptoms and with hæmorrhages (fungous and bleeding state of the gums, melæna, epistaxis, purpura); the symptoms lasted three months, and ended in recovery in August, 1904. But the same state reappeared a year later, in October, 1905. When all other treatment had failed I made, at the request of her physician, an injection of human serum to prevent the great loss of blood that occurred during menstruation. On November 11th and December 21st the patient was given an injection of 15 c.c. in the veins. The first injection did away with the fungous state of the gums and prevented the hæmorrhagia; but, although the other forms of bleeding did not assume their former intensity, the condition of anæmia, which had not been modified at all, increased, and the evolution of the disorder went steadily on to a fatal termination in March, 1906.

Although in this instance the serum injections appear to have had a certain degree of antihæmorrhagic power, they showed themselves much more efficacious in the second case, that of a woman of twenty-one, with whom, without any apparent cause, an intense degree of anæmia manifested itself (1,700,000).

During this condition a variety of forms of hæmorrhage appeared: purpura with big ecchymoses, fungous and bleeding condition of the gums, metrorrhagia, melæna, hæmaturia, and hæmorrhage of the retina. Blood drawn from the little finger took three hours to coagulate. When I was called on to examine the patient, November 25, 1905, signs of meningeal hæmorrhage had appeared: rigidity

of neck and limbs, intense headache, Kernig's sign, exaggerated reflexes, motor-ocular paralysis, strabismus, etc. These symptoms were increasing in intensity, and a fatal issue to the case seemed imminent. I began by injecting into the veins 15 c.c. of fresh anti-diphtheritic serum, and the signs of meningeal hæmorrhage abated, the fungous state of the gums disappeared, the different hæmorrhages ceased, and the patient began steadily to improve to such an extent that three weeks later her blood contained 3,350,000 corpuscles per c.m. A second injection of defibrinated human blood was given to prevent the loss of blood at menstruation from being excessive, and with success. But at the beginning of 1906 the fungous condition of the gums reappeared, and from that time on the serum injections failed to have any effect. There was no longer any tendency to hæmorrhage, but the symptoms predominating were those of anæmia, and the loss in corpuscles increased continuously until the woman succumbed toward the end of January.

Such are the cases that I have observed, and the conclusions that I have drawn from them are that injections of fresh blood serum have proved themselves efficacious in checking hæmorrhage in all dyscrasic conditions, more so, apparently than any other form of treatment, and in particular than the administration of calcium salts. Their mode of action, however, is not dissimilar to that of the latter: the calcium salts, which form a substratum for the coagulating ferments, stimulate their energy, which seems disordered or deficient in hæmorrhagic conditions; injections of fresh blood serum introduce directly into the circulation the necessary coagulating ferments, and in all probability help the system as well to produce such ferment on its own account.

In cases of prolonged blood dyscrasia, in which a toxic cause is affecting the blood in a continuous and repeated manner, since the injections have no effect on *it*, the arrest of hæmorrhage may only be momentary, and is in any case insufficient to produce recovery. After temporary improvement the anæmia and hæmorrhage reappear, and these continuous cases are at the present moment beyond our therapeutic control. In the same way in acute cases, such as hæmorrhagic smallpox, or high degrees of hepatic insufficiency, the suppression of the loss of blood will not enable us to cure the patient. To do this, we should need to be in a position to attack

the cause of the disorder by directing our therapeutics against the primary disease.

The following is the technique that I suggest for these serum injections:

In order to stop dyscrasic hæmorrhage in an adult, 15 c.c. of fresh serum injected into a vein, or 30 c.c. beneath the skin, are generally sufficient. There is no objection to injecting a fresh dose two days later. With children the amount injected should be reduced by half.

The sera of man, the rabbit, horse and cattle have been found equally efficacious, although *in vitro* the action of human serum is more evident in correcting the disorder; but in order to obtain full therapeutic effect, no serum should be used that is more than two weeks old.

On the other hand I do not advise that the serum taken from the bovidæ be used, notwithstanding its efficacy; it alone among the different sera has given rise in my hands to accidents sometimes alarming although temporary: sudden and high rise of temperature, rigors, cyanosis and vomiting.

The preparation of serum from the rabbit can be most readily carried out in any laboratory by means of aseptic bleeding at the carotid artery.

In practice I have even used on a number of occasions the antidiphtheritic serum prepared at the Pasteur Institute, which puts into circulation every month supplies of fresh serum; but I think that it is preferable to use ordinary serum when feasible, as it contains all the elements required to check dyscrasic hæmorrhage.

FIVE YEARS' EXPERIENCE WITH AN ANTI-TYPHOID SERUM

BY PROFESSOR A. CHANTEMESSE
of Paris

Whenever a new treatment for typhoid fever is brought forward, three criticisms of it are sure to be made: that it has no efficacy; that it causes intestinal hæmorrhage; and that it produces intestinal perforation. I need not recall how often these assertions were made in connection with Brand's treatment.

Violent criticism does not spring solely from a tendency inherent to human nature: it has also more praiseworthy motives. The chief one of these is the way in which the prognosis varies in different epidemics of typhoid fever. Some small outbreaks carry off one-third of the cases, while others show a death rate of only one-twelfth to one-fifteenth; whence it results that the rate of mortality depends on the nature of a given epidemic, and also on the number of cases that occur. This question of number is so important that it renders insignificant any statistics unless these are made from at least hundreds of cases. As an example of this let me mention the following: In 1901, in Läennec Hospital, during the last nine months of the year, there were 44 cases of typhoid without a death; in the following year in the same hospital there were 42 cases with 11 deaths.

In order really to be worthy of attention statistics upon typhoid fever ought to extend over years without interruption, and to concern hundreds of cases; the data should also be of such a nature that anyone can verify the figures. And in order to enable an opinion to be formed as to the harmlessness or severity of the epidemic in question, and also as to the treatment, there should be groups of patients that do not come under the treatment in course of examination.

For five years now I have used my serum treatment in my wards in all cases of typhoid fever; these patients now number many

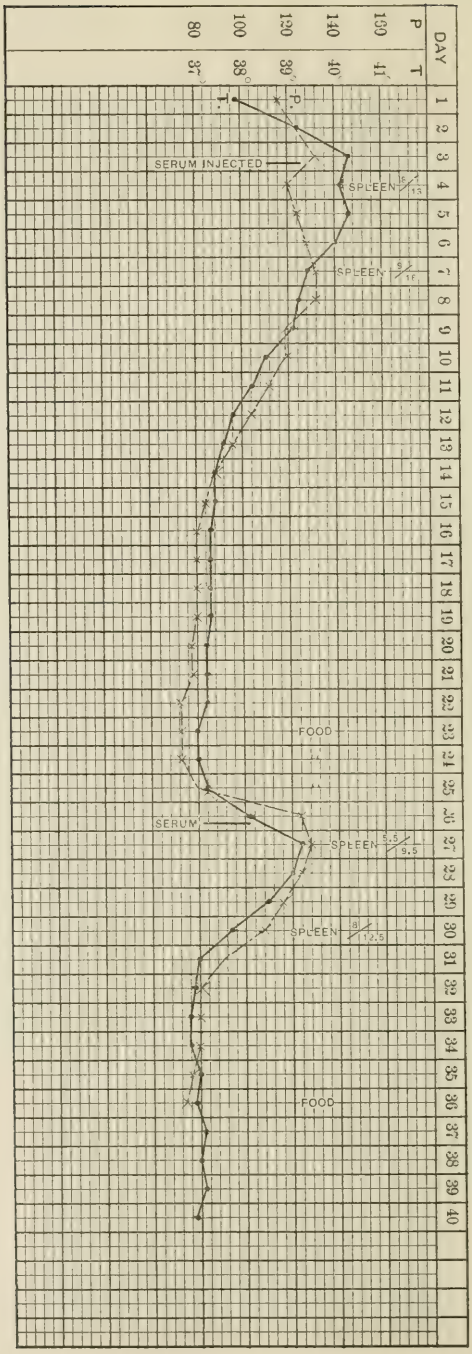


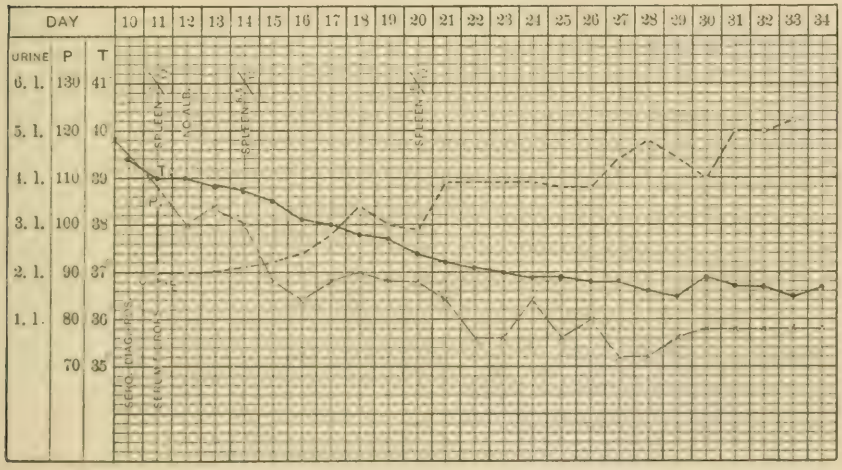
Fig. 1.

hundred, and the results, recovery or death, are inscribed on the hospital registers, which can be consulted by any one. These results I now desire to lay before you, leaving you to verify them at your leisure.

A question that at once comes up is, whether the form of typhoid we have seen in Paris during the last five years has been specially mild or severe. Let us see what has been the number of cases and deaths from typhoid fever in our hospitals for adults.

The official registers of the fourteen large general hospitals of Paris give for the period between April 1, 1901, and December 31, 1905, the following figures: Total cases, 3,595; deaths, 753; average death rate, 17.3 per cent.

FIG. 2.



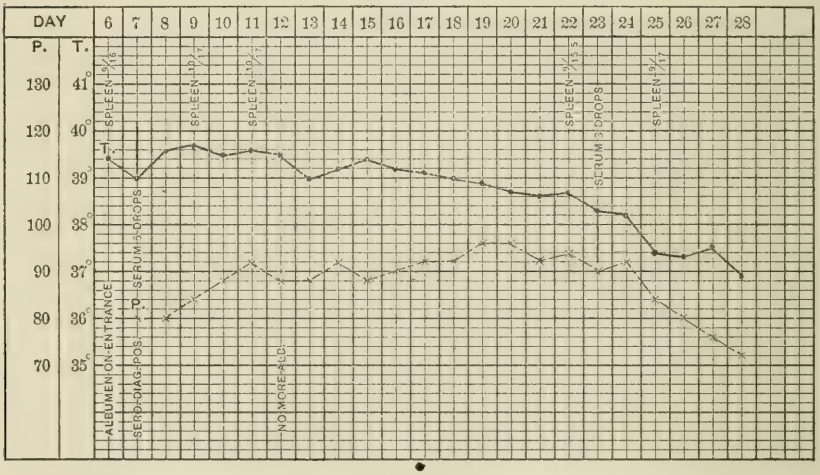
As opposed to this percentage let us take the figures for my wards during the same period: Total cases, 712; deaths, 27; average death rate, 3.7 per cent.

Thus in many hundreds of cases, and during a prolonged period of time, we find in the one instance the usual average death rate, 17.3 per cent., and on the other, 3.7 per cent. In the various Paris hospitals, as in my wards, the different bathing methods, hot, tepid or cold, are in use; the cause of the difference that we note can therefore only be found in the anti-typhoid serum, which has so far only been employed in my wards. Either the figures

that I have given are inexact, and this you can find out in a very short time by consulting the registers; or else these figures are the expression of the truth, in which case you must see that it is feasible to reduce by three-quarters the actual death rate from typhoid fever in our wards. If, as has been said, the value of a human life between the age of twenty and forty is $1,200, the expense in building the two wooden pavilions in which my treatment is carried out, has been a well warranted one.

The temperature curve of patients treated by this serum is entirely changed, and in a perfectly regular fashion. There are two well-defined periods: the first, which follows the injection, and

FIG. 3.

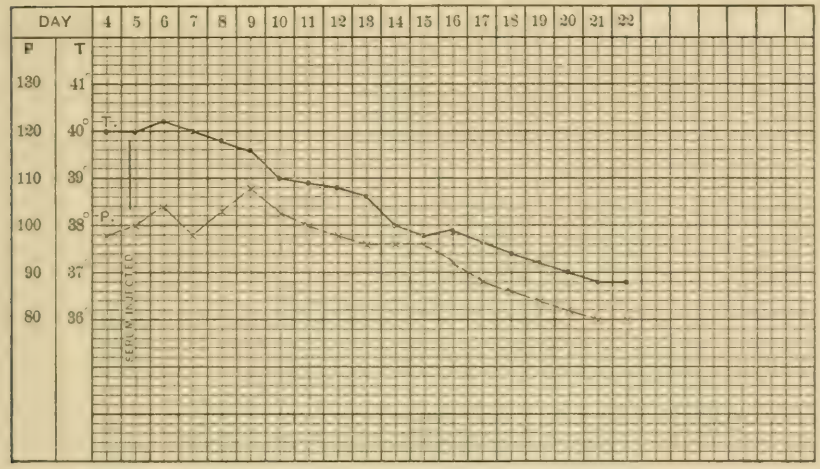


lasts from one to three, four or even five days, according to the severity and age of the disease, period of *reaction,* during which the spleen and lymphoid tissue undergo hypertrophy; and the second, which follows the first abruptly, period of *defervescence.* The earlier the patient is treated in the disease, the shorter the latter period will be. In some cases the temperature falls as rapidly as in the crisis of pneumonia; but as a rule the descent takes the form of lysis, when the case is a serious one and the serum is given late. Some specimen charts are here annexed.

In serious cases with stubborn high temperature, treated somewhat late, the period of descent is slower (No. 3), and necessitates,

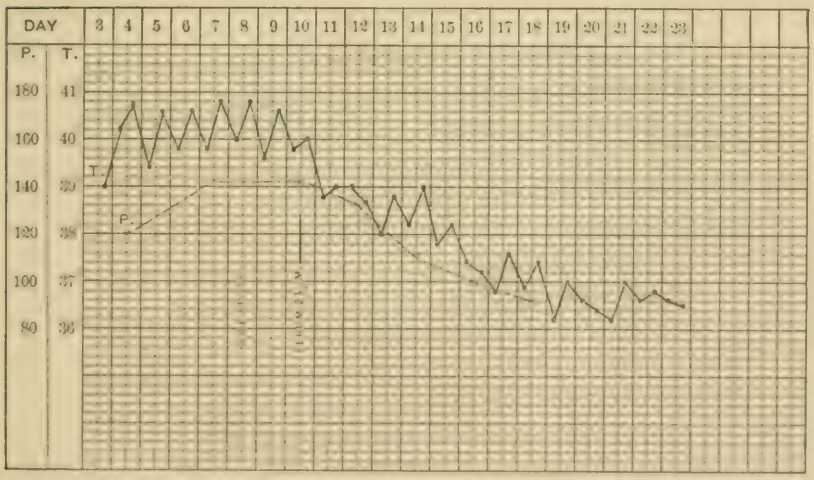
in order to show itself clearly, the intervention of a second injection of serum, of half the amount of the first. After a fresh and brief period of reaction, defervescence then sets in.

FIG. 4.



You will see from these charts what the effect of this treatment is on the pulse. As a general thing its frequency decreases with

FIG. 5.

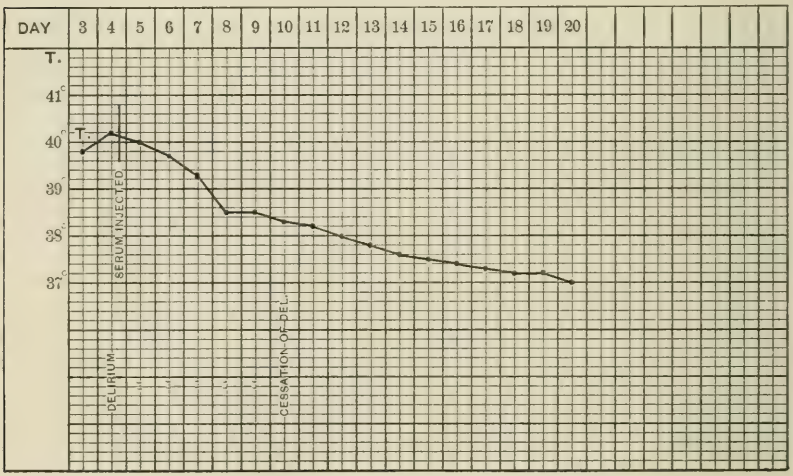


the temperature; in some instances the pulse rises temporarily in spite of a slight decrease in temperature, but this rise, which is

always attended, and this is an important point, with a slight increase of blood pressure, has not at all the unfavorable signification of a rapid pulse with lessened blood pressure seen in typhoid fever treated after the usual method. In patients treated with the serum the blood pressure oscillates between 13 and 17 centimetres of mercury, sometimes 18; and this is why the pulse-frequency here has not the same signification as in Leibermeister's formula. It sounds incredible, but I have seen many adult patients recover though their pulse had run at 150 and even 160 per minute.

This increased tension is accompanied by more active vascularization of the skin. For this reason these patients look extra-

FIG. 6.



ordinarily well: their lips and cheeks are red, and their general aspect is not that of the typhoid stupor. Strangers visiting the wards are struck with the patients' appearance, and remark that they resemble in no way the typhoid patients usually seen.

The patient's general condition is also very quickly improved. Headache disappears in a few hours, and as soon as the reaction period is over, a general and perfectly evident feeling of comfort is felt. Although the temperature continues to present oscillations for some time, the patients feel relieved, wish to eat, and pass much urine. No. 6 is an example of many cases. The condition

of the mouth is excellent, and the diarrhœa soon stops. Constipation, which takes its place, is one of the drawbacks to the method; the constipation has to be watched, and relieved to avoid relapses once the effect of the serum is over.

The action of the serum on the renal secretion is worthy of attention. Very quickly, long before convalescence, there is very marked polyury, and the albuminuria, even when abundant, if of typhoid origin, disappears in a few days. In one case, that of a lady who had had chronic albuminuria following scarlatina for several years, the albuminuria disappeared after an attack of typhoid treated by the injection of serum, and has not reappeared.

The duration of the disease is as a general thing shortened on account of the absence or infrequency of complications. Here again, much depends upon the time at which serotherapy is started. Only when it is instituted early in the disease is recovery prompt; when it is given late in the disease the necessary time is required for the organs, which have been impregnated with toxin, to return to their normal state. In the great majority of cases the loss of weight is very slight during the attack, and the convalescence very short.

The ordinary complications of typhoid fever are rare, as you will see by noticing the causes of the 27 deaths that occurred in my 712 cases: Intestinal perforation 9, ataxo-adynamy 7, pneumonia 3, peritonitis without perforation 1, suppuration of peri-cæcal lymphnodes 1, intestinal occlusion 1, gangrene of the mouth 1, erysipelas 1, rupture of sub-clavian aneurysm 1, renal cancer 1, gangrenous pleurisy, operated on, 1.

I only mention, in passing, the small complications, usually without gravity, such as furunculosis, abscess of the buttocks, otitis, etc., and whose frequency is in inverse ratio to scrupulous cleanliness and astisepsis. A complication which occurs during convalescence in about one and a half per cent. of cases, is phlebitis with œdema of the leg; this, however, soon improves under a strict achloride diet.

But there are two complications to which I must refer at length, as they always assume the foremost place when the question of the treatment of typhoid fever is under discussion; these are hæmorrhage, and perforation of the intestine.

Hæmorrhage, as you have seen, does not appear as a cause of

death among our cases. This is because, nowadays, we can easily treat it when it appears, thanks to calcium chloride, and even prevent it. Thus in serious cases, that have only had the serum injection late, I give toward the middle or end of the second week a little calcium chloride as a preventive, and have found this method useful. Outside of the serum this is about the only remedy I use.

As regards intestinal perforation there is one fact to which I cannot draw your attention too closely. Among my 712 cases perforation only caused death 9 times, and always with patients who received the serum injection at a late date. It never occurred in patients who received injection of serum during the first seven days of fever. I can say in parenthesis that every one of my patients, without an exception, treated by the serum during the first week, recovered.

Among the whole of my hospital cases there were eleven perforations, two of which were operated on successfully. This brings the total death rate from perforation to one and a half per cent.

In order that you may see the full value of this figure, it is necessary to give you the percentage of perforation in thousands of other cases treated by the usual methods, and I shall only mention authors whose names carry weight: Murchison, Griesinger, Curshmann, Harte, Flint. These writers have reported a total of 8,160 cases, with 213 perforations, 2.6 per cent.

The diminution in the frequency of intestinal perforation in the case of patients treated by the serum is therefore only about two-fifths, whereas the death rate is lowered by three-fourths. This is due to the fact that perforation is the result of total necrosis of the intestinal wall, and that this necrosis, an early effect of the disease, has often already taken place when the serum is administered. This is why the serum should be injected at an early date; to do so is to avoid perforation by the mechanism to which I shall now refer.

What is the method of action of this serum, which has such a marked effect on the system of typhoid patients?

Is it antitoxic? There can be no doubt of this, since it puts an end very quickly to headache, diarrhœa and the general symptoms of intoxication. But it is also antitoxic in an indirect man-

ner, as the amount injected is very small, a fraction of a cubic centimetre, and the more advanced and serious the case the smaller the quantity that must be injected.

Is it toxic? The maximum dose that is ever injected beneath the skin of a patient can be introduced with impunity into the brain substance of a guinea pig or rabbit.

Is it bactericidal, in the strict sense of the word? Stern has shown that the bactericidal power of the serum of a typhoid patient decreases progressively as the patient approaches recovery. After an injection of our serum, in proportion as the general condition improves, the bactericidal power of the patient's blood decreases just as it does during the evolution of spontaneous convalescence.

Does it agglutinate the typhoid bacillus? Yes, most emphatically, and in a specific manner.

How does it act? We know that laboratory animals do not contract a disease analogous in evolution to typhoid fever. Still, if with such animals injections are made, some given pure typhoid virus, and others given typhoid virus and serum, it is found that the modifications of the myeloid and especially of the lymphoid tissue are very different in the two cases. The animals with which the serum was used react by increased activity and hypergenesis of the leucopoietic tissue. The same phenomena are observed in man stricken with typhoid and treated by our serum. Of this you can become convinced by examining the spleen with the phonendoscope and by analyzing the blood of our serum patients. The patient's spleen undergoes hypertrophy two or three days after the administration of the serum; in one case No. 1 the diameters of the spleen, as shown by the phonendoscope, rose from 8 x 13 c.m. to 9 x 16 c.m. three days after the injection, and four days after the injection, made for the relapse of this patient, the diameter had risen from 5.5 x 9.5 to 8 x 12.5. No doubt this splenic enlargement is not always as marked as in this instance, but it is always unquestionable and can be demonstrated. It is at the moment when the period of defervescence begins that the spleen ceases to enlarge, and shrinks back in a few days to the volume it presented before the injection.

Examination of the blood shows corresponding modifications that can be seen the day after the injection: Abundance of poly-

nuclears, reappearance of eosinophiles, and, a few days later, increase in number of the large mononuclears. In short, the modification is very similar to that observed spontaneously in the blood when natural convalescence occurs. There can be no doubt that in the rest of the lymphoid system modifications analogous to those of the malpighian corpuscles of the spleen take place, and it is in those irrefutable observations that lies the proof of the action, or better, unusual activity, under the stimulus of the serum, of the apparatus for natural defence of the system against typhoid infection. What the serum does is to give rise to extreme stimulation, to hypergenesis, of this lymphoid tissue; and therein lies the secret of its salutory action, the means whereby the system arouses forces that were slumbering, and makes an energetic defence against the flood of typhoid toxins.

On this account, you will realize the extreme usefulness of administering the serum at an early date, at a period when the lymphoid system is still capable of furnishing the effort that is to be demanded of it. When this leucopoietic tissue is profoundly intoxicated it is preferable not to ask more of it than a moderate effort, and only to inject a small amount of serum. It is for this reason that the benefit of the method will only be apparent in the hands of those who have learned to use it.

This serum has not been used in my wards only. For three years now Professor Brunon, of the Rouen General Hospital, and Dr. Josias, of the Paris Bretonneau Hospital, have treated several hundred patients with it, and their results have been similar to mine in all particulars.

Medicine

THE COMMON CARDIAC ARRHYTHMIAS AND THEIR CLINICAL SIGNIFICANCE

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To within a few years our knowledge of the cardiac arrhythmias was very confused. The heart action was ordinarily described as being more or less irregular and the seriousness of the condition was judged accordingly. Yet the studies of physiologists and clinicians, especially of such men as Mackenzie,[1] Wenckebach,[2] and Hering[3] have so illumined this subject, that we are now able to distinguish a number of well-defined types of arrhythmia, and to form some idea as to the way in which these affect the diagnosis and prognosis of the underlying condition. The exact analysis of the various arrhythmias has been accomplished through the study of graphic records of the venous pulse; but it is frequently possible to distinguish them at the bedside without the aid of special apparatus. In the present paper typical venous records from the commonest forms of arrhythmia will be analyzed and the attempt will be made to show how the arrhythmias may be identified with more or less accuracy during the course of an ordinary physical examination. Finally the diagnostic and prognostic significance of the different arrhythmias will be discussed briefly.

A complete classification of the cardiac arrhythmias presents considerable difficulty. Many forms occur so rarely that they may be regarded as curiosities. Important and interesting as these are in a comprehensive study of this subject, to the ordinary practitioner they present little of practical interest. Other forms of arrhythmia are met with daily, and it is to these that I desire to direct your attention; for upon their proper recognition may rest

a proper diagnosis or prognosis. The three most common forms of arrhythmia are (1) respiratory irregularities, (2) extrasystoles, (3) the absolutely irregular pulse. These three types include at least ninety-five per cent. of all cardiac arrhythmias. The subject of heart-block is also of great importance, but it will not be discussed here; partly because it is uncommon and partly because it has received so much attention in the current literature of the past two years.[4]

THE NORMAL VENOUS PULSE

An exact analysis of an arrhythmia can be made only from tracings, especially from the venous pulse. A tambour is usually placed over the course of the right internal jugular vein and the pulsations are recorded on a moving piece of smoked paper. These pulsations are usually easily distinguished in the neck owing to their undulating character, which differs plainly from the single sharp pulse of the carotid artery. Not infrequently the pulsations in the external jugular vein are more apparent than are those in the internal jugular, but as a rule the latter yield the better tracings.

In order to analyze such a tracing, it is necessary to compare it with a simultaneous apex or arterial pulse tracing. Only by comparison with such a standard can we locate the various waves which make up the venous pulse. To obtain simultaneous records of two or more pulsations, the ordinary systems of tambours used in any physiological laboratory may be employed; but for clinical purposes some more convenient apparatus is advisable. I have found the Jaquet sphmygmo-cardiograph very satisfactory. In addition to the radial pulse and the time marker, this little piece of apparatus possesses two tambours that can be used simultaneously for other tracings. It is especially suitable for rapid work owing to the fact that no adjustment of the levers against a moving drum is necessary and the points write almost directly over one another.

Figure 1 is an example of the normal type of venous pulse as obtained by this instrument. It shows three main positive waves which are ordinarily called the *a, c,* and *v* waves. The first of these, the *a* wave, is caused by the contraction of the right auricle. Two views as to the method whereby the auricular contraction produces this wave have been advanced. According to the first, the

entrance of the superior vena cava into the right auricle is closed during auricular contraction and the interruption of the onflowing stream of blood produces a stasis or recoil wave: according to the second, there is an actual regurgitation of blood from the auricle into the superior vena cava during auricular systole, and this is transmitted up the vein as a wave of increased pressure. At present it is not possible to decide to what degree these two factors participate in the production of the ordinary *a* wave. Nor is the question one of great importance in our discussion. The main point is that the *a* wave on the venous tracing indicates the auricular contraction.

The *c* wave occurs simultaneously with the carotid pulse, beginning just after the onset of ventricular systole (see Fig. 3). Mackenzie's interpretation of this wave as a transmitted carotid pulse received general acceptance until recently when Morrow [5] revived an old view of Potain that a positive wave at this time occurs in the veins themselves. Morrow founded this view largely upon the results of venous tracings from animals, which showed a *c* wave even when the carotid artery had been tied. Morrow also obtained this wave from man on tracings taken over the external jugular vein, remote from the carotid artery. I have noticed the same and Figure 1, for example, was taken from a markedly pulsating external jugular vein where no arterial pulse could be felt. Tracings from pathological conditions also support the view that there is a positive wave in the jugular veins synchronous with the carotid pulse. Thus in tricuspid insufficiency there appears an early systolic wave, the venous character of which is attested by the fact that it is propagated at the slow venous rate and not at the rapid rate that is characteristic of arterial pulsation.[6] Furthermore, as we shall see, there is a wave at this time in certain arrhythmias which is certainly of a venous nature.

It seems to me quite certain therefore that two elements enter into the formation of the *c* wave of ordinary venous tracings: (1) a transmitted carotid pulse and (2) a true venous wave. The *c* wave begins distinctly after the beginning of the apex beat. So far as the arterial portion of the wave is concerned this delay is due to two factors: (1) the period of ventricular tension which intervenes between the beginning of ventricular contraction and the

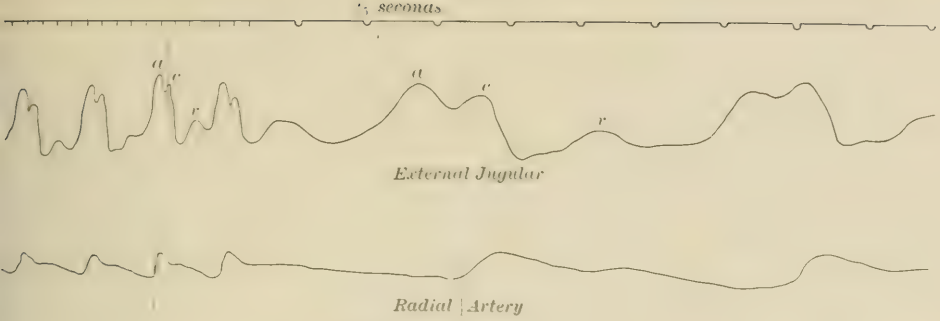
moment when the semilunar valves open, and (2) the time lost in the propagation of the wave from the heart to the neck. So far as the venous component of the *c* wave is concerned, it seems to take its origin from a positive wave that is produced in the auricle at the beginning of ventricular systole. This wave has been demonstrated in man both externally when the bony covering of the chest wall was deficient [7] and internally from within the œsophagus.[8] It begins with the onset of ventricular systole but does not appear in the neck until some time later, for the reason that venous waves travel slowly. Although the *c* wave seems ordinarily to be made up of these two elements, at times the two apparently do not exactly coincide, for Bard claims to have obtained them separately on the same tracing, and Hirschfelder states that they may differ in time by as much as .05 seconds.[9]

The third positive wave on the venous pulse, the *v* wave, can also be demonstrated on tracings taken directly over the auricle.[8] It seems to be due in part to the collection of blood in the right auricle just previous to the opening of the tricuspid valves, and in part to an upward movement of the base of the ventricle at the end of systole. It is terminated by the opening of the auriculoventricular valves and the subsequent rush of blood into the right ventricle. Since about 0.1 seconds are lost in the transmission of this wave from the heart to the neck, it occurs there in early ventricular diastole. We find the wave particularly well marked in conditions of auricular stasis such as occurs in well marked tricuspid insufficiency and in so-called auricular paralysis (Figs. 5 and 6).

RESPIRATORY IRREGULARITIES

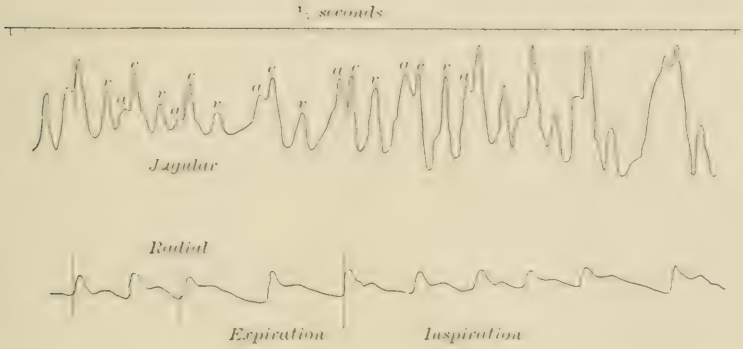
When a young individual breathes deeply and slowly, the pulse rate is normally more rapid during inspiration than during expiration. Under certain conditions these respiratory variations become excessive, so that they may justly be termed an arrhythmia. It is not easy to draw the line that separates the physiological from the pathological in such cases; but for convenience we may say that respiratory variations are pathological when they are perceptible to the finger during quiet respiration. We meet with all grades of respiratory arrhythmia from those that are hardly perceptible on palpation to extremely marked variations. In Figure 2, for ex-

FIG. 1.



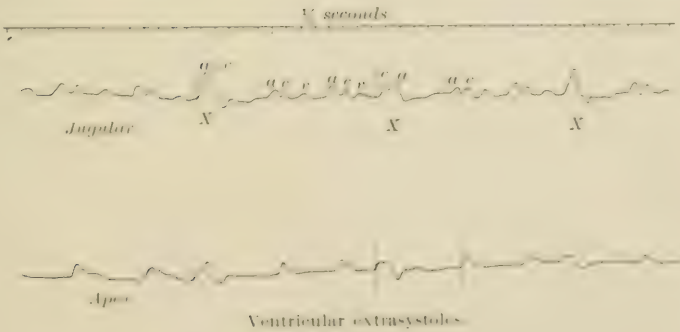
Normal venous tracing.

FIG. 2.



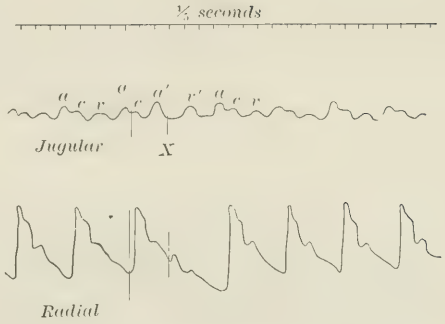
Respiratory arrhythmia.

FIG. 3.



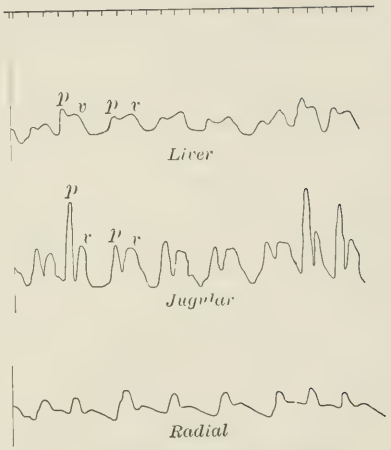
Ventricular extrasystoles.

Fig. 4.



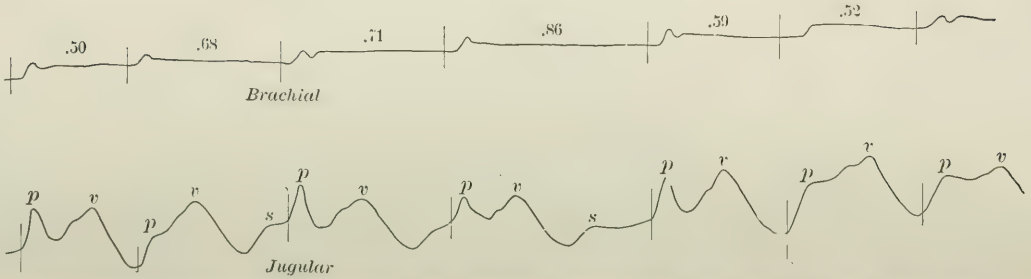
Auricular extra systole.

Fig. 5.



Absolutely irregular rhythm.

Fig. 6.



Absolutely irregular rhythm. The figures above the brachial pulse represent the duration of the pulse in seconds.

ample, beats of 0.7 second's duration are followed by those of 1.3 seconds' duration. This individual was breathing slowly and moderately deeply, which somewhat exaggerated his variations. Nevertheless his arrhythmia was plainly palpable on quiet respiration. Lommel charts a pulse which changed during quiet respiration from beats of 0.63 second's duration to those of 1.10 seconds' duration. Peters [10] states that he has felt variations of pulse length in the ratio of 3:1, but fails to mention whether these had been exaggerated by forced breathing. From these examples I think that no one will question that such variations deserve the name of arrhythmias, and that they need consideration in the discussion of this subject.

A more exact analysis of this form of arrhythmia, as illustrated in Figure 2, shows that during inspiration the rate became increasingly more rapid until the individual wave was shortened to about 0.7 seconds. Then just after the onset of expiration a sudden slowing occurred and the pulse wave abruptly lengthened out to 1.3 seconds. Gradually the lengthened beats shortened again, and so the cycle was completed. In other tracings of this character the lengthening of the beats is not so sudden, but in the more pronounced instances of respiratory arrhythmia, the slow beats usually begin abruptly just as they do in this figure. The venous pulse from this patient shows that each *c* wave is preceded by an *a* wave, indicating that the cause of the arrhythmia lies high up in the heart. Other tracings on a rapidly moving sheet of paper show, furthermore, that there is no appreciable difference in the time relations between the *a* and *c* waves at different points of the curve. The propagation of the wave of contraction over the heart takes place at a uniform and normal rate. Occasionally, as Rehfisch [11] has shown, there is a slight retardation in the passage of the wave from the auricles to the ventricles during the slow portions of the arrhythmia, but it is never sufficient to be in itself the cause of the irregularity.

The recognition of such an arrhythmia at the bedside is usually easy. It is only necessary to watch and control the respirations. If the movements of the chest are carefully noted while the pulse is being counted, it will be found that the rapid beats occur during inspiration and the slow ones during expiration. The patient may be asked to breath slowly and deeply and in this way the effect of

respiration upon the pulse may be exaggerated or controlled. Finally the patient may be told to hold his breath for a time; when the pulse will usually after a few wavering beats, settle down to a regular rhythm. By practicing some one or all of these manœuvres it is usually possible to make a definite diagnosis of respiratory arrhythmia without the use of any special apparatus.

Respiratory arrhythmias are observed in various conditions. In the first place, they are more pronounced in youthful individuals, hence Mackenzie's designation of "youthful irregularities." Peters [10] in a recent study of irregularities occurring in diphtheria classifies these irregularities according to the age of the patient. He found that whereas they occurred in every one of his patients under the age of five years they were very rare after the twenty-second year. He found similar results in a study of the pulse of scarlet fever patients and quotes Villy as reaching similar conclusions in a series of 177 diphtheria patients examined. In all these cases the irregularities were almost entirely of the respiratory type. The reason why respiratory irregularities are rare in elderly individuals will be explained later in considering the causes.

Respiratory irregularities are especially apt to develop toward the close of infectious fevers. Thus Lommel [12] states that in a small epidemic of typhoid fever, which affected mostly persons under twenty years, respiratory irregularities were more or less marked on quiet respiration in two-thirds of the convalescents. I have already quoted Peters' statements as to their frequency in diphtheria and scarlet fever. The irregularity does not usually develop during the course of the fever itself when the pulse is rapid, but appears along with the post-febrile bradycardia. If the pulse for any cause, such as excitement, exertion, etc., becomes temporarily rapid, then the respiratory irregularities tend to disappear. Occasionally they also appear during the course of those infections in which a slow pulse is present during the fever itself, as in meningitis and typhoid.

Respiratory irregularities are especially apt to occur in neurasthenic and hysterical individuals. They have also been described as occurring during the slow pulse that follows any short exertion.

The physiological explanation for the respiratory irregularities is derived partly from animal experiments and partly from experiments and clinical observations on man. In the dog the pulse rate

increases on inspiration and decreases on expiration. These irregularities disappear if the vagi are cut or if they are paralyzed by atropin. The changes in heart rate are therefore caused by vagus impulses. Since they occur even though the chest cavity is opened, they do not depend upon reflexes from mechanical changes in the lungs. In such an animal the irregularities disappear during periods of apnœa but appear as soon as attempts at respiration take place. It would seem as if the rhythmic stimulus to respiration radiated from the respiratory center to the vagus center in the medulla and that this caused the rhythmic variations in heart rate.

A similar explanation probably holds for the respiratory irregularities in man, for in him also paralysis of the vagus terminals by atropin injections cause them to disappear.[3,11] The pathological exaggeration of these variations under certain conditions is to be attributed to an excessively labile vagus influence. Possibly the heart itself is at fault in being excessively irritable to normal stimuli; but on the whole, opinion inclines to the view that the condition is primarily a nervous one and is due to the unusual variations in the strength of the stimuli sent out from the vagus center. This view is supported especially by the fact that these variations occur when the central nervous system is known to be diseased, and are usually absent in conditions of cardiac weakness.

Respiratory irregularities are most pronounced when the vagus control over the heart is most highly developed. As a person grows older his heart becomes less and less subject to vagus influence, and such drugs as atropia and amyl nitrite which paralyze the vagus produce less and less acceleration of the heart. It is in the young individual that the vagus plays such a large part in the control of the heart rate, and it is in him also that these respiratory variations are apt to be most marked. We have seen that the postfebrile respiratory arrhythmia is usually accompanied by bradycardia. The latter, in many instances at least, is due to an excessive vagus tone, for it is more or less eliminated by injections of atropin.[3] In such convalescents the vagus tone not only seems to be increased but also to be subject to excessive variations. The respiratory arrhythmia of neurasthenics is to be classed with the many other neurasthenic phenomena of nervous instability and irritability; for example,

the exaggerated tendon reflexes, the excessive vasomotor variations, springing pupils, etc.

Respiratory arrhythmia when marked is apt to cause considerable alarm. This is especially true of the postfebrile form. It develops at a time when all seems to be going well, when the temperature has fallen to normal or subnormal, and when the heart has slowed down to less perhaps than its ordinary rate. The physician then notices that the pulse has become irregular, even to the point where one beat is almost twice as long as its predecessor. Naturally considerable anxiety may be felt concerning the condition of the heart. Many clinicians have held that postfebrile bradycardia is a sign of heart weakness or of heart fatigue [13], and to them the added irregularity must appear a serious symptom. The majority of recent writers, however, who have carefully differentiated this particular form of arrhythmia from those of more ominous significance have come to view the respiratory irregularities after infectious diseases as being almost without significance.[3,10] I have seen no case in which a respiratory irregularity at the close of an infectious disease was followed by serious cardiac trouble. Usually they last only a few days, or at most, a few weeks, and then disappear. In one of my patients the arrhythmia apparently followed a pneumonia ten months before. He was, however, a most pronounced neurasthenic, which probably accounted for the long continuation of the irregularity. Except after acute infectious diseases respiratory irregularities are rarely apt to cause alarm. Physicians are usually prepared for moderate degrees of irregularity in neurasthenics and children, and the occurrence of such irregularities does not alarm them.

Sometimes the presence of respiratory irregularities are of slight diagnostic significance in patients who complain of indefinite cardiac symptoms. Their presence favors the view that the symptoms are of a functional or neurotic character; for only rarely are serious cardiac conditions associated with respiratory irregularities. Unfortunately in later life, when the question as to the functional or organic character of indefinite cardiac symptoms becomes so important, respiratory irregularities are nearly always absent owing to the reduction of vagus tone, and this absence consequently has no diagnostic significance.

EXTRASYSTOLES

Nearly or quite as frequent as respiratory variations in pulse rhythm, are those due to the occurrence of extrasystoles. The latter have been variously termed abortive systoles, premature beats, missed beats, bigeminal, trigeminal beats, etc.; but the designation of extrasystoles conveys a more exact idea as to their real nature. Physiological studies have shown that if any part of the heart be stimulated by an extra abnormal stimulus it will ordinarily respond by a contraction after a short latent period. This extra contraction does not occur if the stimulus is applied immediately after a preceding systole for the reason that the heart muscle has not had time to recover its irritability. Such abnormal premature contractions are called extrasystoles. Experimentally they may be produced by various kinds of stimuli, especially electrical and mechanical. We do not know the exact nature of the stimuli producing extrasystoles in man, but the resulting effects so exactly correspond with experimental extrasystoles that we cannot doubt that in man also extrasystoles are due to some sort of an abnormal stimulation of the heart muscle.

Clinically we may distinguish extrasystoles according to their points of origin. Adopting this method of division, we have those originating in the venous sinuses, the auricles, the auriculoventricular bundle of His, and the ventricles. Figure 3 serves to illustrate the nature of ventricular extrasystoles. In three places the otherwise regular heart beat is interrupted by premature contractions (x). The key to the venous pulse here is the *c* wave which is easily recognized by the fact that it immediately follows the apex beat. In the second extrasystole the venous tracing differs from the normal in that the *c* wave is not preceded by any *a* wave and that it is followed by a high wave distinctly differing from the *v* wave of the normal portion of the venous pulse. The ventricles have evidently contracted prematurely without having been preceded by an auricular contraction. The high wave following the premature *c* wave is set midway between the normal *a* waves on either side and is itself undoubtedly an *a* wave. In spite of the premature contraction of the ventricles, therefore, the auricles have continued to beat rhythmically. The auricular contraction immediately following the ventricular extrasystole is not followed by a

second contraction of the ventricles for the reason that the ventricles have not recovered sufficient irritability after their extracontraction. The next auricular contraction, however, is followed as usual by a ventricular systole. The auricles have maintained their rhythm throughout the ventricular irregularity. It therefore follows that the period of time between the two pulses preceding and following the extra systole is equal to two normal pulse periods. The lengthened period after the premature pulse is spoken of as a compensatory pause.

In the other extrasystoles on this tracing the ventricular extracontractions occurred relatively later, so that they approximately coincided with the auricular contractions. As a consequence the right auricle contracted against closed tricuspid valves, the blood could not escape into the right ventricle and was forced back into the jugular vein. This is the explanation for the large wave marked $a + c$. These two represent the most common types of ventricular extrasystoles. Of the less common modifications the most important is that in which the auricular contraction immediately succeeding the ventricular extrasystole is followed by a normal ventricular contraction owing to the fact that the ventricle has sufficiently recovered from its extrasystole. This is especially apt to occur in slowly beating hearts. In such a case the extrasystole is interpolated between two normal ventricular beats and the compensatory pause is absent.

Figure 4 represents an extrasystole originating in the auricles. This extrasystole is indicated on the venous tracing by the occurrence of an unusually high wave marked a'. This wave is higher than the normal v waves and begins a little earlier. It is due to an abnormally early contraction of the auricle. The resulting wave coincides with the v wave of the preceding systole and so produces the marked elevation a' on the venous tracing. The extra arterial pulse is so small that it shows only on the radial tracing. The v' wave of the extrasystole is somewhat larger than normal on account of the stasis of blood in the auricle. We have here then an extrasystole which originates in the auricles and spreads thence to the ventricles, a typical auricular extrasystole. It will be noticed that the period intervening between the extra pulse and the next succeeding normal pulse is no longer that the normal pulse interval. Com-

parison of the auricular contractions, however, shows that there is a slight compensatory pause after the extra auricular contraction. This disappears, however, owing to the slow transmission of the extra wave to the arterial pulse. The compensatory pause here, even in the auricles, is not so long as in the ventricular extrasystole illustrated in Figure 3. There the auricular rhythm was unaffected, so that the time between the two normal beats on either side of the extrasystole was equal to twice the normal interval between beats. Here on the other hand the auricular rhythm has been disturbed by the auricular extrasystole. This is not always so in auricular extrasystoles, but when it occurs it shows that the extrasystole must have started above the ventricles.

Extrasystoles arising from the atrioventricular bundle of His appear to be of considerable importance clinically, but their differentiation from ventricular extrasystoles is not always easy. The stimulus proceeds in either direction from its point of origin and consequently the auricles and ventricles contract more or less simultaneously. A similar coincidence of auricular and ventricular contractions may be due to ventricular extrasystoles, for the premature ventricular contraction frequently coincides with the normal auricular (Fig. 3). In practice such simultaneous contractions of auricles and ventricles during extrasystoles are often met with, and they give rise to a single large pulsation in the neck instead of the normal undulations. We are often at a loss, however, to determine whether the extrasystole originated in the ventricles or in the His bundle. We can only be certain of the latter when the auricles contract prematurely, so that we can rule out the possibility that a premature ventricular contraction has coincided with a normal auricular.

The clinical recognition of occasional extrasystoles is usually easy, and even the various combinations can often be identified at the bedside without the use of apparatus. If the normal heart sounds be reproduced by the symbols:—

— ⌣ — ⌣ — ⌣ — ⌣ — ⌣ — ⌣

then the heart sounds in certain extrasystoles may be represented by

— ⌣ — ⌣ — ⌣ — ⌣ — ⌣ — ⌣

while in other extrasystoles the sounds are as follows:—

— ⌣ — ⌣ — — ⌣ — ⌣ — ⌣

In the first extrasystole the semilunar valves have been opened and a second sound results. In the second, the valves have not been opened. Consequently no second sound is heard and no pulse is felt. Even though the second sound be heard, the pulse may not be felt on account of the small amount of blood that has been forced into the aorta. Where the extrasystole produces no palpable pulse wave it is often spoken of as a dropped or omitted beat; where the wave is felt it is spoken of as a premature beat. There is no essential difference between the two, however, for they are both extrasystoles and their true character is easily recognized by auscultation over the heart. Dropped beats are occasionally produced in another way, however. The auricles contract regularly but the ventricles fail occasionally to follow. This condition of partial heart block is easily distinguished on auscultation on account of the absence of the first sound during the pulse omission.

Occasionally the compensatory pause after an extrasystole is very much shortened, and we may recognize even on auscultation that the period between the two normal beats on either side of the extrasystole is less than double the normal interval. If such be the case, we may then infer that the extrasystole has originated either in the auricles or in the venous sinuses, or else that we are dealing with an interpolated ventricular extrasystole. When, however, the compensatory pause is of such length that the period between the normal beats is twice the duration of a normal beat, then the extrasystole may have originated either in the auricles or in the ventricles and the jugular pulse alone will decide the question.

Inspection of the jugular vein frequently shows a single violent pulsation at the time of the extrasystole instead of the normal undulations. This ordinarily means that the auricles and ventricles have contracted more or less simultaneously, so that an excessive amount of blood has been forced back into the veins, and we may infer that the extrasystole has arisen either from the ventricles or from the His bundle. Possibly in some instances auricular extrasystoles might cause confusion on account of the large wave produced by the fusion of the premature *a* wave with the preceding *v* wave (Fig. 3). We see, therefore, that while it is usually easy to recognize extrasystoles on auscultation, it is difficult to estimate their points of origin without the assistance of accurate venous tracings.

Extrasystoles occur in a variety of conditions. They may be

produced experimentally by direct mechanical or electric stimulation of the heart muscle; but such experiments do not aid us much in explaining those that occur in man. Of greater clinical interest is the fact that extrasystoles often follow a rise of blood pressure, as was shown by Knoll in 1872. This seems to be the explanation of certain extrasystoles that occur in man.

Clinically extrasystoles occur most frequently in patients with suspected myocardial disease. They are especially frequent in elderly arteriosclerotics, and in them they are often one of the earliest signs of functional disturbance of the heart. Extrasystoles may persist for years with no serious cardiac insufficiency; but their appearance in a patient past middle life must always be regarded with suspicion. I have encountered extrasystoles several times in very obese patients without peripheral arteriosclerosis. In such patients the cause may lie in fatty deposits about the heart or in arteriosclerosis of the coronary arteries to which they seem especially subject. Extrasystoles do not ordinarily develop during the acute myocardial lesions of infectious diseases. When they do appear at such times they are of a relatively worse significance.

Extrasystoles also occur when there is no reason to suspect serious cardiac disease and when the subsequent history of the patient practically excludes it. Hering [3] denies that they may be caused directly by nervous influences, for they cannot be induced experimentally by direct stimulation of the nerves supplying the heart. Indirectly, however, nervous influences may certainly give rise to extrasystoles, for they may contract the blood vessels and so raise the blood pressure. Beyond doubt also extrasystoles may be incited in patients, directly or indirectly, by nervous influences. For example, Aug. Hoffmann [14] cited the case of an hysterical boy who developed extrasystoles every time that he attempted to solve a problem in mental arithmetic. Similarly Vanysek [15] reported the case of a neurasthenic who had used tobacco to excess and who learned after a time to induce and stop a continuous bigeminal rhythm. Careful studies of the blood pressure in such patients should determine whether or not the extrasystoles were associated with a rise of blood pressure.

Extrasystoles not infrequently occur in certain intoxications. I have seen them in two young patients with exophthalmic goitre

and in one of those the irregularity became less pronounced after removal of a part of the goitre. Extrasystoles frequently occur in habitual users of tobacco. In three such patients I have seen the extrasystoles cease a few weeks after the habit was discontinued. Digitalis, tea and coffee, uræmia, and the toxins of infections are also accredited with the ability to cause extrasystoles. In many of these the changes in heart rhythm are almost certainly of a functional character, for the irregularity disappears when the toxemia is removed. It seems probable that such extrasystoles are due to an increased irritability of certain parts of the heart, which causes them to respond to stimuli that would be ineffective under normal conditions. The ultimate history of such patients is deserving of careful study, however, for it is possible that the extrasystoles may indicate actual damage to the heart muscle. The idea that tobacco, for example, may sometimes lead to arteriosclerosis and the cardiac degenerations is being impressed upon physicians more and more.

Extrasystoles vary in number from time to time in a most unaccountable manner. On one day a patient will have extrasystoles after every normal beat, a continuous bigeminal rhythm; while for days afterwards few if any will be present. Extrasystoles occur especially during slow heart action, for the longer rest between beats allows the portion of the heart affected to become more irritable and consequently to respond to relatively weaker stimuli. Hering demonstrated that after an injection of atropin extrasystoles may disappear owing to the increased heart rate. In this case the extrasystoles came at a regular interval after the regular systoles; and when the latter occurred more closely together, time was not given for the extrasystoles to appear. In a patient with a continuous bigeminal pulse I found that a large atropin injection caused the extrasystoles to disappear at about the time that the shortening of the regular beats caused an interference with the extrasystolic beats. This was accomplished, however, only by using a slightly toxic dose ($^1/_{33}$ grain atropin). The extrasystoles did not reappear for some days after the injection. Extrasystoles often appear during the slow heart action that immediately follows a short but violent exertion. This fact may be used to test a patient's susceptibility to this irregularity. They are rarely seen at the height of infectious fevers, and Mackenzie regards them as particularly omin-

ous at such times. Anæsthesia with ether frequently causes extrasystoles to disappear, as I have noted in several cases. In two of these the irregularity did not return for several weeks after the operation.

The appearance of occasional extrasystoles is in itself of little moment; the condition causing them should alone be considered. When extrasystoles occur frequently, however, and especially when a series of extrasystoles occur in succession, then the abnormal heart action may be the cause of an insufficient circulation and lead to complaints of dyspnœa, dizziness, or cardiac distress. Occasionally patients are conscious of the individual extrasystole. They may complain that the heart stops, that it gives an unusual thump, or that it seems to turn over; and observation of the pulse shows that such sensations frequently coincide with the occurrence of extrasystoles. I have seen one patient who could infallibly call off each extrasystole owing to the sensations that he experienced.

When extrasystoles are associated with manifest cardiac insufficiency their treatment is naturally the treatment of the more serious underlying condition. When no such insufficiency is apparent some exciting cause, such as the abuse of tobacco, tea, or coffee, may be discovered, and the removal of the cause may be followed by the disappearance of the irregularity. In many patients, however, no toxic cause can be discovered; neither does the irregularity seem to depend upon definite cardiac weakness. This is especially true in those patients where the irregularity is apparently of a nervous character or where it appears in the early stages of arteriosclerosis. Unfortunately we do not yet know of any drug which will infallibly cause such extrasystoles to disappear. Various medications have been suggested. Hochhaus[16] recommends quinine combined with digitalis and camphor. Hirschfelder[17] states that digitalis is often effective when the irregularity arises from the ventricles, but that it does harm when the irregularity arises in the auricles. Following the administration of large doses of digitalis to a patient with extrasystoles of ventricular origin, I have seen a prompt disappearance of the irregularity. I have also seen extrasystoles disappear after a toxic dose of atropin and after ether anæsthesia. Unfortunately the inconstancy of extrasystoles makes it difficult to estimate the effect of medication. Many apparently

depend upon an excessive irritability of certain parts of the heart, especially of the ventricles or the His bundle, and a remedy that will lessen this abnormal irritability is what we need. Possibly digitalis may act in such a manner, for we know that it diminishes the conductivity of the His bundle.

THE ABSOLUTELY IRREGULAR PULSE

Next to respiratory irregularities and extrasystoles, the most frequent form of arrhythmia is that which may be termed the absolutely irregular pulse or the pulse of auricular paralysis. In its typical form this pulse possesses three main characteristics: first, no *a* wave preceding the carotid pulse; secondly, a marked positive venous wave in early ventricular systole, and thirdly, an absolutely irregular rhythm. When rapid this rhythm is usually described as delirium cordis; yet the three main characteristics, mentioned above, may be present with a comparatively slow pulse (55 per minute in one of my patients), so there seems little need to separate delirium cordis as a special form of heart action.

Figures 5 and 6 illustrate the arterial and venous pulses in this form of irregularity. It will be noticed that no definite *a* wave precedes the arterial pulse. In the slower pulse (Fig. 6) a wave marked *s* is seen, but this follows the preceding pulse, and I am inclined to interpret it as a stasis wave. Mackenzie early called attention to the absence of the *a* wave in this form of irregular pulse, and his observation has been generally confirmed. I believe that this absence is best interpreted as an auricular paralysis, or at least, as a weakness of such a degree that the auricular contraction is insufficient to give rise to an *a* wave on the venous tracing.[6]

The wave marked *p* occurs nearly simultaneously with the carotid pulse, but it is certainly not due to an arterial pulsation. In the first place, the sizes of the two do not vary together, and it will be seen that the *p* wave is often largest at the very times when the radial pulse is smallest (Fig. 5). In the second place, in a patient with a slow pulse of this character, this wave was seen, timed and obtained on tracings in the external jugular vein, remote from the carotid artery. In the third place, this wave is plainly visible on the liver pulse shown in Figure 5; and since Mackenzie states that arterial pulsations do not appear on liver tracings its appear-

ance here confirms our conclusion that the wave marked *p* is a true venous wave. We have already seen that the *c* wave of the normal venous tracing is due partly to an arterial pulse and partly to a true venous wave. In auricular paralysis, the latter is accentuated owing to the fact that the movements of the ventricle are transmitted uninterruptedly through a motionless auricle instead of being diminished by auricular diastole. In these tracings I have labelled this the *p* wave to emphasize its distinctness from the carotid pulse.

The *v* wave in auricular paralysis is unusually large and tends to fuse with the *p* wave, especially when the preceding diastole has been short. This is due to the inability of the paralyzed auricle to empty itself, which increases auricular stasis and consequently increases the size of the *v* wave. In contrast to the normal venous pulse, where the negative phase during systole is the more pronounced (Fig. 1), we see here that the main fall in the tracing follows the *v* wave. This indicates that the most rapid venous flow of blood toward the heart occurs during ventricular diastole instead of during ventricular systole as is normal.

The absolutely irregular heart rhythm may usually be recognized clinically by the fact that no two pulse beats have the same duration. It is ordinarily termed delirium cordis, though one must be prepared for a slow as well as a rapid irregularity of this character, and at times the irregularity is not at all marked. Unlike extrasystoles no underlying regular rhythm can be recognized. Furthermore the irregularity does not depend upon the respirations and is usually far more marked than most respiratory irregularities. Many ventricular contractions may fail to give rise to arterial pulses, and some do not produce second heart sounds, evidently because no blood has been forced into the aorta.

In mitral stenosis the presystolic accentuation of the murmur disappears when the pulse changes from the regular to the absolutely irregular rhythm (Mackenzie, Wenckebach). The presystolic accentuation of the murmur of mitral stenosis is due to the accelerated flow through the constriction during contraction of the left auricle. When the latter ceases to contract, then the presystolic accentuation of the stenosis murmur is lost. Frequently the accentuation of the murmur then becomes early diastolic, when the flow of blood through the mitral orifice is favored by ventricular diastole.

Auricular paralysis is encountered most frequently in the late stages of mitral valve disease and next in frequency in patients with myocardial disease, especially old arteriosclerotics. The marked positive waves in the venous pulse during ventricular systole have led some authors to believe that the absolutely irregular pulse is invariably associated with tricuspid insufficiency, but this view seems incorrect. The tracings differ from those of typical tricuspid insufficiency,[6] and many patients with absolute arrhythmia have no heart murmurs whatever. We must regard auricular paralysis therefore as distinct from tricuspid insufficiency, though the two probably frequently occur in the same patient.

Opinions differ as to the manner in which the absolutely irregular pulse develops. Mackenzie, for example, pictures a gradual change from a normal venous pulse; while others think that the change is more or less abrupt. I have observed a patient who showed a typical irregular pulse of auricular paralysis on one day and a normal and regular pulse on the day following. Others have made similar observations so that there seems some ground for the belief that the absolutely irregular pulse may develop abruptly and also pass away abruptly. Such paroxysms of irregularity tend to become permanent, however, and when once well established the absolute irregularity usually persists until death.

The absolutely irregular pulse always affects the prognosis most unfavorably. The irregular action of the ventricles and their improper filling on account of the auricular paralysis, diminishes the amount of blood thrown into the arteries. Venous stasis results; the veins are usually swollen and pulsating, the liver enlarged and tender. This stasis, however, is often less marked than the stasis caused by pronounced tricuspid insufficiency. Some patients with irregular heart action are able to do light work for years, but as a rule they are more or less incapacitated for any effort.

The abrupt change to an absolutely irregular rhythm that takes place when the auricles cease to contract, has led many authors to assume that the stimulus to contraction no longer proceeds from its normal point of origin, the venous sinuses. Opinions differ as to its new origin, however. Some have held that the rhythm proceeds from the auriculoventricular bundle of His, others that there is a blocking between the venous sinuses and the right auricle, and still

others that the auricles have passed into fibrillation. The evidence at hand does not permit a definite decision in this matter.

Patients with auricular paralysis often do remarkably well when placed on digitalis, which is especially true of those with mitral valve diseases. The heart action becomes slower and a larger proportion of the beats are felt at the wrist. Yet the general characteristics of the absolutely irregular pulse continue, and only very rarely does the heart become absolutely regular or does the auricular wave reappear on the venous tracing.

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THE URGENCY OF EARLY DIAGNOSIS OF CANCER OF THE STOMACH *

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Our views regarding the incidence and cure of internal cancer have undergone a complete change in the last decade or two—this is chiefly on account of the great advance in internal surgery. This advance imposes new obligations on internal medicine. It is difficult to get away from the trammels of the past with its pessimism and become thoroughly imbued with the spirit of the newer school with its wider outlook and greater hopefulness.

The knowledge that cancer is at first a definite local disease, absolutely curable, if removable, throws upon physicians the momentous responsibility of an early recognition of the disease as the first step essential to its cure. If we recognize the existence of cancer in the stomach, bowel, gall-bladder, omentum, etc., while still local, and before infection extends beyond the original seat of disease, the first and by far the most difficult step is taken towards the cure, to complete which it is only necessary to do the mechanical part—a mechanical part we should see is undertaken only by the capable expert. It is the " irony of fate " that our part, although the most difficult, and the most important, should be awarded scant recognition, as compared with that willingly accorded to the mechanical part. The art is preferred to the science that gives it birth.

What are we to understand by the early diagnosis of *Cancer of the Stomach?* Some have defined early diagnosis as recognition of the condition before the occurrence of a demonstrable tumor. Such a definition is, however, not correct, as successful removal has been effected after the tumor became apparent; and, a fact that is much more often true, the disease may become wide-spread, infecting neighboring glands and organs long before the existence of a tumor

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can be determined. A small carcinoma may prove more malignant than a large one.

A diagnosis to be early must be made while the disease is still localized and its complete removal therefore still possible. This point in the history of the case is usually passed long before a tumor becomes apparent, but in a few cases the infection is still circumscribed after even a large tumor has been formed.

So strongly do Czerny and Rindfleisch, and later Kraske,[1] regard the outlook as unfavorable after a palpable tumor forms, that they hardly deem operation justifiable after its appearance.

I. The Subjective Symptoms

Is it possible to make a diagnosis in gastric cancer before the appearance of a tumor, or rather while it is still a local disease?

We must recognize the fact that there are no symptoms of cancer apart from those due to secondary effects such as cardiac or pyloric obstruction, thickening and deformity of the stomach, adhesions to neighboring structures, degeneration of the gastric glands, gastric stasis from injury to the musculature and defective peristalsis, etc.

As Brinton long ago pointed out the symptoms of these disturbances are usually so insidious in onset that suspicion is not aroused in most cases until it is too late for radical measures to be taken.

A family history of cancer, especially gastric, and a history of trauma, should be regarded as increasing the liability to cancer of the stomach.

Probably the most important consideration in the early diagnosis of cancer is the somewhat sudden occurrence of derangement of the functions of the stomach in a person over 30 or 40 who has hitherto been quite free from gastric disturbances. These symptoms are often attributed to errors in diet, causing at first acute, and later chronic dyspepsia. The symptoms may yield temporarily to treatment, but soon recur. Not rarely the symptoms begin abruptly with hæmatemesis. In such cases the progress may be rapid; there is usually intractable vomiting, and rapid and progressive loss of strength, and emaciation.

[1] Boas. *Diseases of the Stomach*. English-American edition, p. 584.

In occasional cases the onset is merely with vague dyspeptic disturbances which grow gradually worse. These are the cases which rarely seek advice until the disease is too far advanced for radical cure.

Next to the sudden onset of digestive disturbance is the *progressive decline in appetite;* in time there is complete loss of appetite, and later, repugnance to food, especially to meat. This is an important and often an early symptom of gastric cancer. The appetite is usually good, not rarely craving in ulcer, and it must not be overlooked that it is occasionally so also in cancer. A man aged 66 at present under observation has a good appetite for ordinary food including meat, although there is some gastric stasis with offensive odor, no hydrochloric acid, an abundance of lactic acid, and such signs of ulceration as occult blood, mucus and pus in the stomach contents. The left lobe of the liver is large and nodular and below it there is an indistinct fixed mass.

Pain is not usually an early symptom, but there is often a feeling of pressure and discomfort in the epigastrium, chiefly after meals. Later pain gradually develops, but varies chiefly with the degree of gastric stasis. It is not characteristic and therefore not of much differential value.

Eructation is frequent; it may be acid, and often gives temporary relief. The gas at first is odorless, but later may become very offensive, owing to decomposing particles from the tumor.

Vomiting is a frequent, but by no means a constant symptom. It is most constant as well as most copious, of course, in disease of the pylorus; it may be absent throughout, when only either curvature is affected.

In acute cases vomiting may be among the first, and most distressing symptoms. In these cases, however, the progress of the lesion is so rapid that serious advance has probably been made before the severe symptoms set in. Such cases are frequent among those occurring in early life, that is before 30 years of age. Kuttner (*Berlin. Klin. Wochenschr.*, x. 44, 840) believes cancer occurs quite frequently in earlier life and that it is often incorrectly diagnosed.

Loss of *energy, strength,* and *weight* are usually early symptoms, occurring even before pain and vomiting. They are very

suggestive if they are progressive, even under careful treatment. *Anæmia* is usually associated with them and adds to their significance; it is probably often due to occult bleeding.

Fever has been observed in from 25 to 50 per cent. of cases usually of the ulcerative and metastatic types and probably due to septic absorption or secondary inflammation. In a few cases, however, no secondary causes can be found, and in these the fever must be due directly to the cancer itself, which, like tuberculosis, appears to possess pyrogenic properties. However temperature disturbance is rarely an early symptom.

Boas has met with *œdema of the ankles* in 12 per cent. of his cases. It may occur during the early stage. It is transitory. As it occurs in other conditions it does not constitute more than a suggestive sign.

II. The Objective Symptoms

1. *Physical Examination.*—In making an examination, due care should be taken to have the patient facing a good light, lying evenly on the back and the chest and abdomen well exposed. Failure in discovering a tumor, even by good physicians, is not rarely due to want of observance of these obvious precautions. At this early stage there are rarely signs of a tumor as one has not yet formed, but there may be signs of spasm of the walls of the stomach, as described by Cruveilhier over 50 years ago, and to which Boas has drawn attention anew under the designation of "gastric rigidity." When present it is at first so slight as only to be felt by the hand placed below the left costal margin, as a faint contraction of the fundus and lasting only a moment. Later as the contractions become more marked and rigid, they can not only be felt, but the abdominal wall, if thin, can be seen to rise as a slight mound, which, after a brief period, disappears. When so marked as this it gives the patient a sensation of spasm and may cause an audible gurgling sound as it disappears. For obvious reasons "rigidity" does not occur when the stomach is empty and is most marked if it be moderately full. It recurs at variable intervals, and may usually be excited by friction, especially by the cold hand. "Gastric rigidity" is a sign of much diagnostic value as it indicates forcible contraction of the fundus excited by obstruction at the pylorus. It may

begin fairly early, after the obstruction has developed, probably while the disease is still localized in most cases and in time to permit of successful resection of the pylorus, infection of the lymphatic glands not having yet occurred.

The stomach should be *inflated* in order to determine its size, position, and relation to other organs, and to a tumor if such exists. The colon should also be inflated, especially if there is a tumor of uncertain attachments. Inflation may enable us to determine the seat of the tumor, those in the pylorus before adhesions form being movable, while in the lesser curvature they are relatively fixed.

In palpating the epigastrium it is of much assistance to have the patient sit up in bed and rest against the examiner who sits behind him; the examiner can then pass his arms around the patient and palpate the abdomen. In this position the abdomen is relaxed and the liver and other organs as well as new growths, if not fixed, fall forward and downward, and may come within reach of the physician's hands.

The left *supraclavicular glands* should be examined as in some cases they are infected and may be so even early in the disease. I have seen it as a late sign but not an early one. Absence of enlargement is of no value as contraindicating the existence of cancer.

2. *Examination of Gastric Contents.*—One of the most important steps *is the examination of the contents of the stomach* under varying conditions, to determine the promptness of discharge of the food, the powers and rapidity of digestion, the degree of HCl secretion, the quantity of mucus present, and whether lactic acid, blood (evident or occult), pus, and tumor particles are to be found.

Free hydrochloric acid is nearly always absent in gastric cancer, even at an early stage, but it is also absent in too many people under varying circumstances to render its absence in suspected cancer more than suggestive. It is often absent in various nervous disturbances, as hysteria and neurasthenia; also in some cases of chronic gastritis and in atrophy of the gastric mucous membrane. The varying conditions under which HCl is not secreted both with and without organic disease, and the fact that in the same case it may be absent at one examination, and present even in excess at another a few hours or days later, leaves no room for doubt that the variability of its secretion is due to nervous influences.

Moore has found it absent in cancer of other organs as uniformly as in those in which the stomach is involved. Its almost invariable absence in cancer of the stomach and pernicious anæmia, in which the gastric mucous membrane is found at autopsy not to be atrophic, can scarcely be accounted for, except as due to disturbance of the nervous functions, either from irritation or depression. It is probable that too much is made of the theory that most, if not all, cases of cancer with persistence of free HCl secretion have formed on an old ulcer in which usually the base is thickened. Excess of hydrochloric acid in gastric secretion can scarcely confer any immunity from cancer; although the development of cancer in such a case appears to be soon followed by a diminution and, later, cessation of the secretion. Hyperchlorhydria is of very frequent occurrence and is associated with a variety of gastric conditions, such as ulceration, catarrhal gastritis and atony of the muscular wall of the stomach. But its occurrence is vastly more frequent than that of these conditions, and probably the chief reason that cancer is not more often found associated with it, is due to the depressing influence on the secretory nerves exercised by the cancer, either directly, or more probably, through the absorption of toxin peculiar to the cancer, or from gastric contents. The point to be made clear and emphasized is that there seems little ground for the belief that excessive secretion of hydrochloric acid confers immunity against the development of cancer of the stomach. In some cases of cancer, the secretion of hydrochloric acid is restored by the improvement resulting from the free drainage of the stomach effected by gastro-enterostomy. The suppression of HCl secretion without ulceration or gastric stasis point to the cancer itself as the cause of its suppression. The following is a very interesting case of persistent hyperacidity in which cancer developed:

Col. M., aged 50, had suffered in a varying degree, often severely, for three years, with epigastric distress after food. The acidity was often extremely high, the gastric contents requiring at times 1 c.c. deci-normal NaOH solution to neutralize the free HCl acidity of an equal volume of gastric contents, and 1.5 c.c. or even more for the total acidity. At times there was undue retention and also intermittent gastro-succorrhœa. There was nothing to indicate the occurrence of ulceration. He improved well under "rest cure,"

but relapsed almost immediately on going quietly about again. He declined operation for a possible pyloric lesion although it was advised in view of the possibility of ulcer or even cancer. A year later he submitted to operation, a gastro-enterostomy being done and carcinoma of the pylorus found, but too far advanced to permit of its removal.

A second case differs somewhat but is equally instructive:

S. R., aged 60, a retired cavalryman, keeping hotel for some years and drinking much strong spirits. For about 3 years he had complained of flatulency and acidity. His weight had fallen from 212 to 155 pounds. The stomach was found much dilated and containing remains of food probably taken some days previously. On testing, the acidity proved to be about normal, although the quantity of stomach contents was much greater than normal, diluting the HCl secretion which must therefore have been in great excess. There appeared to be an indefinite mass at the pylorus as shown on inflating the stomach. The liver was slightly enlarged and appeared considerably hardened.

With lavage, etc., he improved, gaining 10 pounds in five weeks, but the persistence of gastric stasis and the possibility of pyloric carcinoma rendered operation without delay advisable. Owing to difficulty in resecting the pylorus and threatening collapse under the anæsthetic gastro-enterostomy was done. For a day or two recovery was doubtful, but he slowly improved, and later gained rapidly, his weight increasing 60 pounds in a few months, and his general condition became quite satisfactory although he drank heavily again. A year later he began to be troubled with indefinite pains in the abdomen, the liver increased in size and became irregular. There was still a small amount of free HCl in the stomach contents at the last examination, made two months before his death, which took place nearly two years after the operation. Had the pylorus been removed a complete cure would possibly have resulted; such would almost certainly have been the result had he come under observation a few months earlier.

Other cases might be cited, particularly that of a lumber merchant seen a few years ago suffering from severe gastralgia with excess of hydrochloric acid secretion. He improved satisfactorily under treatment, and went to the lumber districts to recuperate. The

symptoms recurred and after a few months grew worse. I learned that he died of gastric cancer the following year. In the light of our now larger knowledge there is good ground to believe that this man's life might have been saved and his health restored.

I have given these cases in detail because they are exceptional although not very rare. In the great majority of cases there is absence of hydrochloric acid early in the history, and such absence in association with other symptoms is of material aid in making a diagnosis. A few years ago absence of hydrochloric acid was regarded as almost a pathognomonic symptom, now many have gone to the other extreme and attach no importance to its absence. Like extreme views generally, both of these are wrong. Absence of HCl is a valuable sign in association with others, but it is only one of many we have to consider in determining the condition in any given case.

The constant presence of *lactic acid* is strongly indicative of the existence of gastric cancer, but it does not occur until a late stage of the disease. It may be found in other diseases than cancer, but rarely if ever, constantly, or in copious quantities. It is found in from 75 to 90 per cent. of cases so that "its presence speaks strongly for the existence, but its absence has no weight in favor of the absence of cancer" (Osler and McCrae). It does not appear in free quantities until hydrochloric acid disappears, and by this time there is more or less stasis of food in the stomach, and probably some degree of ulceration has taken place.

In this connection the following case is of much interest:

H. Y., aged 53, had a history of "weak stomach." He was very ill last winter with rather ill-defined symptoms in which the stomach disturbance was prominent. He made a fair recovery, but during the past summer had severe burning in the epigastrium, somewhat relieved for a short time by food. He looked much distressed and was somewhat emaciated, weight 125 pounds. On examination some mucus could always be obtained from the stomach. Stasis of food was fairly marked; there was no hydrochloric acid, but lactic acid was found at each examination, even in the fasting stomach in the morning. There were no long bacilli (Oppler-Boas) present. There was no blood or pus in the mucus, nor was there any offensive odor. With "rest cure" and lavage the mucus soon

disappeared, but the lactic acid was persistently present, hydrochloric acid absent and the stasis only moderate. The discomfort about the pyloric region persisted, and he showed little general improvement, his weight not altering. After full consideration an exploratory laparotomy was deemed advisable although if there was a cancerous growth it was too far advanced to be removable. From the rather late onset of discomfort after meals and its chief seat being in the region of the pylorus it was highly probable that there were perigastric adhesions and the removal of these might bring relief. Two bands were found near the pyloric orifice but the stomach, appearing healthy in all parts, was not opened. After this the stomach contents still showed absence of hydrochloric acid secretion, but there was now no lactic acid, and the food was properly discharged from the stomach. Unfortunately the distress after food still persisted when he was discharged.

This man's condition gave much anxiety, lest on the chronic gastritis carcinoma had developed, although there is not much danger of cancer in chronic gastric catarrh. Yet in view of the persistence of lactic acid in even the empty stomach there was reason to fear that this might be one of the rare cases in which this result occurs.

The *long bacillus,* first described by Boas, and later very fully by Oppler, is usually found if lactic acid is constantly present; but it is not an early sign, as it appears only after the disease is well advanced.

Microscopical examination of the gastric contents can be of material assistance only after ulceration has begun and is therefore seldom available for early diagnosis. If the precipitate from the stomach contents is spread into a thin layer between two plates of glass and held against a dark background, solid particles can be readily seen and taken out for microscopical examination; the eye of the stomach tube should also be searched for any adherent particles, as well as the material got from the tube. If nothing has been obtained from the stomach it is important, in withdrawing the tube, to compress it with the fingers, so that any contents or particles lodged in it may be obtained for examination. If ulceration has begun, pus, blood corpuscles, and bacteria, as well as small particles of tissue from the base or sides of the ulcer may be

found; the latter may be so characteristic as to render an exact diagnosis possible. The odor of a particle in the eye of the tube, if fœtid, may give a valuable clue.

Blood in the stomach contents is an important sign of ulceration, but it may occur without it. It may come from varicose veins in the œsophagus, or from the congested gastric mucous membrane. The bleeding may occur with the gentlest use of a soft tube if there is even moderate retching, especially if the digestion is deranged and there has been epigastric discomfort. The bleeding is due to congestion associated with a slight catarrhal inflammation of the gastric mucosa. The condition is not infrequent after alcohol or table excess, or any condition that deranges digestion. Bleeding may be so slight as to be demonstrable only by chemical tests; the presence of disintegrated blood should be sought for in both the vomit and the fæces. Persistent occult bleeding is a valuable sign, especially if associated with retention of gastric contents and defective gastric secretion. On the other hand the constant absence of blood from the stomach contents and the fæces would be strong evidence against the existence of cancer.

The *motor function* of the stomach deserves careful consideration. It may remain nearly normal to the end. The testing should be under identical conditions. The best course is by giving an abundant meal in the evening and making an examination in the morning, a tube being passed to evacuate the stomach contents, after which the stomach should be washed out to make certain that it is quite empty.

The *contents of the fasting stomach* obtained by the passage of a tube should be carefully examined. The presence of even minute quantities of blood with pus; or of pus alone, or mixed with mucus, especially if present on repeated examinations, rendering the existence of cancer almost certain. The presence of these constituents are due to the occurrence of ulceration and therefore evidence of a fairly advanced stage of the disease. In most cases therefore they are not available for early diagnosis, but the examination should be made in all cases.

Salomon's *albumin test* is regarded as reliable by those who have used it. Kuttner from an extensive experience confirms its value. It is carried out by giving the patient a fluid meal, free from albu-

minoids, at noon, and thoroughly washing out the stomach in the evening. Next morning the fasting stomach is rinsed out several times with 12 ounces (400 c.c.) of physiological salt solution, the solution being poured into, and syphoned out of, the stomach several times. The solution is then tested for albumin with Esbach's fluid. If it becomes opalescent from a flaky precipitate, the presence of albumin is demonstrated, and the existence of cancer practically confirmed. The presence of albumin is possible in simple gastritis, but Kuttner in his large experience has not met with it. That the sign as an early one is doubtful, and it is therefore not probable that it will aid in the early diagnosis.

Röntgen Ray examination may prove of use by showing irregular peristalsis, which may be caused by the abnormal state of a portion of the wall of the stomach. The stomach may be deformed by the growth, and thus show a shadow of irregular outline with recesses and projections.

This also will rarely be found in the early period of the disease and therefore is not available for early diagnosis.

Gastroscopy as yet offers little if any aid in making a diagnosis. Possibly such improvements may be made in the method as to make it practicable as well as valuable.

3. *The Blood.—Leucocytosis* of moderate degree is frequent, but is a late rather than an early symptom. *Digestive leucocytosis* is usually absent, but is present in so large a minority, as to render it of little value in diagnosis.

The *blood,* apart from the moderate leucocytosis, shows no characteristic alterations. The red corpuscles are seldom reduced much below 2,000,000 per c. mm. even in extreme anæmia and emaciation. Occasionally there are less than half that number. The cause of this relatively moderate diminution lies in the fact that there is much reduction also in the serum of the blood. In some cases in which there is persistent vomiting of copious gastric secretion there is even marked polycythæmia, 6,000,000 or more per c.mm., on account of the depletion of the blood serum through the stomach. A further cause is lack of absorption of water by the bowel, owing to the obstacle to the passage of the fluid into the intestine, in cases of pyloric stenosis.

Although these findings bear no resemblance to those of *per-*

nicious anæmia, yet occasional cases of cancer present conditions closely resembling those of that disease. The lemon-tint, lack of emaciation, high-color index, and very low blood count, may be found, and there may be improvement with rest and care. In such cases there are doubtless associated conditions that cause these peculiarities in the symptoms.

The following case of secondary anæmia is interesting, as showing a resemblance to both cancer and pernicious anæmia. Cancer had been diagnosed two years before he was referred to me as a case of pernicious anæmia, in 1903. Rev. J. W. C. aged 58. He had had "dyspepsia" since boyhood and occasional bleeding from piles for 20 years, but no bleeding for some months until recently. He complained of weakness and was very pallid but not emaciated; there was a slight lemon-tint. His physician had found less than 2,000,000 red corpuscles per c.mm., and 37 per cent. of hæmoglobin. He gave him arsenic freely. The stomach contents contained much mucus, some recent blood, no hydrochloric or lactic acid, and the food showed little digestion. A subsequent examination was attended by such profuse bleeding that no further attempt was made. On careful enquiry it was found that he had had black tarry stools from time to time for over two years. On subsequent examinations during the following two months there was about 30 per cent. hæmoglobin, and red corpuscles 2,500,000—a marked secondary anæmia, evidently due to the prolonged free gastric hæmorrhages. He took no meat or vegetables as they caused distress. His diet consisted chiefly of eggs, bread, butter and cream. He has improved greatly and looks well, but he still has occasional recurrence of gastric distress followed by tarry stools. His red corpuscles are up to 5,000,000 but the hæmoglobin rarely rises above 70 per cent. He fears any further stomach examination and declines an operation.

Thrombosis of the veins of the extremities as a sign of cancer was originally pointed out by Trousseau. In his lecture on "Simple Chronic Ulcer of the Stomach" he said: "Should you, when hesitating between chronic gastritis, simple ulcer, and cancer, observe a vein become inflamed in the arm or the leg, you may dispel your doubt, and pronounce in a positive manner that there is cancer."

Although it is rarely that a diagnosis cannot be made before

phlebitis occurs, yet in occasional cases if pain occurs in the calf or thigh, and tenderness is found deeply in the calf and along the course of the femoral vein, with or without œdema of the limb, it serves to confirm what was only suspicious.

Recently I was asked to see a man, aged 52, ailing for some months and showing rapid loss of weight and strength during the last six weeks, and in whom there was phlebitis in the femoral and deep veins of the calves. He also had some *ascites,* another sign of abdominal cancer as well as of other, especially tuberculous, lesions in the peritoneal cavity.

Unfortunately these signs, like such others as an undoubted tumor, cachexia, tumor particles in the stomach contents, expiratory fixation of the stomach, etc., while positive indications of the existence of cancer are also positive indications that the disease is too advanced to permit of a successful radical operation.

It is unnecessary to say then that diagnosis of gastric cancer in the early stage always presents great, often insuperable, difficulties. In many cases, nothing more than a probable diagnosis can be given. There are no pathognomic signs to aid us, so that we have to depend on the general symptoms. To properly elicit and interpret these, it is necessary to make repeated and full examinations at short intervals. As in all cases of difficulty, we should return to the examination of the case afresh and without bias from previous examinations,—the general history, the color, weight, energy, pain, discomfort, appetite for various kinds of food, and all physical signs, should be carefully studied. It should be borne in mind that in occasional cases of cancer there is improvement with gain in weight, but it does not last long, as in cancer of the stomach, the nitrogen out-put always exceeds the in-take. If no improvement results from a few weeks' treatment, there is additional ground for suspicion.

Each examination should embrace the contents, the motor power, position and relationship of the stomach, the blood, and the general condition. It is only by consideration of all the signs and symptoms and their relation to one another that, in most cases, a diagnosis is possible. More mistakes arise in this, as well as in other diseases, from want of care in examination than from want of knowledge on the part of the examiner. In the stomach troubles

of patients over 40 years of age, especially beginning after that age, we should not rest content until the diagnosis is reasonably certain that cancer does or does not exist. If the profession were fully alive to the great importance and urgency of the matter, early diagnosis would become more and more frequent.

One of the most common causes that prevent early diagnosis lies at the door of the patients themselves. They so often regard the digestive disturbance as trivial and resort to home remedies trusting to a recovery in the near future. Thus, in many cases, they delay to present themselves until too late to hope for a cure as the surrounding structures have already become infected.

Differential Diagnosis.—Of the conditions that have to be differentiated from gastric cancer, the most frequent of course is *dyspepsia* in its various forms. Frequently this is impossible. If the condition continues to grow worse notwithstanding careful treatment the indications are that the more serious disease exists; yet in not a few cases of functional disturbance matters grow worse even with the greatest care. There is rarely the increasing emaciation and loss of strength that marks the cancerous disease.

Ulcer is the next condition which causes the greatest difficulty in diagnosis. In cancer the symptoms, including pain, are usually more persistent, the appetite grows progressively worse until there is repugnance to food, treatment fails more completely, wasting is more marked, and the anæmia and loss of strength are progressive. In ulcer there is usually a long history of stomach trouble, but the appetite is usually maintained and may be excessive. In cases of cancer secondary to ulcer, the pain is usually more severe and paroxysmal, and hæmatemesis is frequent. The progress is rapid in such cancer cases and perforation is liable to occur.

A palpable tumor may be present in each. The indurated ulcer is not rarely mistaken for cancer even when exposed by section. It may be impossible to avoid such an error if the cancer develops on an old ulcer. As a rule the general condition of the patient is much less serious in the ulcer with such marked induration than in a cancer with such a large tumor formation; and in cancer the tumor usually becomes fixed early by adhesions, but remains mobile in ulcer.

The following case which I saw three years ago is one of this

nature. Mrs. A., aged 40, complained of marked disturbance of digestion, pain, vomiting and loss of weight. The abdomen was relaxed and in the right lower quadrant of the abdomen two tumors were to be felt, one oblong, in the right iliac fossa, the other rounded, lying half way between the first tumor and the umbilicus. Both were freely movable. The one in the iliac fossa could be pushed upward behind the liver and proved to be the right kidney. The second was in the pylorus as shown by inflation of the stomach. The gastric contents were copious, and contained an excess of HCl. There was no doubt that the pyloric mass was due to gastric ulcer, as her condition was too well preserved to be compatible with so large a carcinomatous mass. If the latter, the lymph glands must have been infected by that time, and therefore rest and careful treatment was advised and progress closely watched. She improved rapidly and when I saw her three months later no trace of the tumor could be found and her general condition was satisfactory.

Hypertrophic pyloric stenosis may be difficult to distinguish from cancer, as in both there is usually a tumor and stagnation of food in the stomach, but the tumor is usually fixed in the latter but movable in the former. The chemical examination may be similar in both, but blood is seldom found in simple stenosis. Hypertrophic stenosis has a protracted history, but the difficulty is to exclude the development of secondary cancer.

One other method remains to be discussed, that is, the exposure of the stomach by a small incision—exploratory laparotomy. By this means not only can the condition be definitely determined in most cases, but the removal of the diseased part proceeded with, where such is advisable. To operate simply for diagnosis is, to my mind, never justifiable; to do so without having thoroughly exhausted every other means is to be unreservedly condemned. Operation should not be undertaken unless the signs distinctly indicate the organ that is affected. No " roving commission inside the abdomen " is ever justifiable, nor is operation for diagnosis in any case of advanced carcinoma except for the relief of such conditions as gastric stasis. The aid of the surgeon should not be suggested even to our own minds until we have exhausted every means that can aid in making a diagnosis. The examinations should be full and complete, omitting no investigation that can aid in determining

the condition, and they should be done promptly, without any unnecessary delay. In cases of doubt the examination should be repeated, in some cases several times, with our minds as unbiased as if the case were a new one, as we are often led astray by the impressions already formed.

A great obstacle to laparotomy for treatment and diagnosis is the objection of the patient to it; but there is another, and that is, the hesitancy, if not the repugnance, of the physician himself. The patient's objection is often but the reflex of that of the physician. The best means to overcome both lies in the making of prompt, full, and repeated examinations, so that a definite conclusion as to the necessity to act may be arrived at without undue delay. If such a course were generally pursued we, as well as the public, would gradually become educated in the importance of such a rational course, with the result that an increasing number of cases would be permanently relieved. The most important step towards an early diagnosis is the arousing of our suspicions; once they are aroused, to delay full investigation when possible, would be criminal. I do not wish to be understood as minimizing the responsibility in recommending operation in these cases. Too often operation is adopted as an easy method of overcoming a difficulty, a course no capable physician or surgeon should countenance.

To carry out these principles, it will be necessary to operate in all cases of gastric ulcer resisting treatment, especially after middle life, and in those showing signs of pyloric stenosis. Even in early life it is the best course in obstinate cases. In the hands of those specially trained in gastric surgery the results in recent years show wonderfully great success and low mortality. But operation should be advised only after the most thorough examination, and this requires expert knowledge of as high a character as does the operation.

In conclusion it is only necessary to emphasize again the importance of prompt diagnosis in every case of gastric disturbance commencing after 40 years of age. In these and all cases of suspected cancer repeated full examinations should be made, using every possible aid in making a diagnosis. When there is reasonable ground for a diagnosis of cancer, laparotomy should be done unless there exists some condition contraindicating it.

A STUDY OF GASTROPTOSIS FROM THE RADIOGRAPHIC STANDPOINT

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The ability to bring the various portions of the gastrointestinal tract within the human range of vision is one of the latest achievements to be accredited to the X-ray in connection with its successful application for purposes of diagnosis. It is true that radiographs of the stomach were made soon after the discovery of the X-ray, but it is only quite recently that it has been used as a successful and efficient diagnostic agent in connection with diseases of the digestive tract.

Of course in this connection its field of usefulness is limited, but nevertheless, in those conditions in which it has been found applicable, it gives promise of attaining the same position of prominence and importance among the other methods of examination that it holds in the diagnosis of renal calculus.

This paper is limited to the subject of Gastroptosis, and the discussion of this condition will be confined to a radiographic study of ptosis of the stomach and the associated condition, dilatation.

The method of making an X-ray examination of the digestive tract differs in some respects from those used in examining the other structures of the body. As the radiograph is a picture of the shadows made by objects or structures which offer more or less obstruction to the passage through them of the X-rays, it follows that in order to obtain such a picture of any particular structure of the body, that structure must be capable of absorbing the rays to either a much greater or a much less degree than the surrounding tissues. A bone appears as a very distinct shadow in the radiograph because the calcium salts in its composition absorb a greater proportion of the rays than do the surrounding soft parts. A collec-

tion of gas in the colon is represented on the plate as a darker area because the gas displaces the soft structures which throw a shadow, while it offers practically no obstruction to the passage of the short ether waves.

The walls of the stomach do not differ materially in their density to X-rays from the various other soft structures around them, and their thickness is small in comparison. Therefore a radiograph of the stomach itself cannot be made, but it is possible to make a satisfactory skiagraph of anything within the walls of the stomach having sufficient density to throw a shadow. The ordinary food contents are not sufficiently dense for the purpose. Whatever substance is used when radiographing the stomach must, even in comparatively small amounts, be capable of absorbing a large proportion of the rays penetrating the body, must be easily administered, and must not produce any toxic or undesirable physiological reactions. Some of the inert salts of bismuth seem to fulfill these requirements better than anything else. In nearly all of our examinations the subnitrate has been employed. With the requisite amount of bismuth in the stomach we may obtain radiographs of the gastric contents which will indicate in a satisfactory manner the location and the limits of the walls of this organ. Although the stomach may sometimes be fairly well outlined if it be inflated, this method is not reliable and the skiagraphs made in this way do not show all of the desirable details. Moreover, a stomach full of gas is not a natural condition of affairs, to say nothing of the discomfort to the patient and other disadvantages attending this procedure. Also, it is doubtful whether this method is productive of accurate results, as distension of the walls by gas is not always likely to force them into the position they assume when their contents is an equivalent bulk of food. Gaseous distension might be too uniform.

A good skiagraph of the stomach is always apt to appeal to the artistic sense, but this should be the least important aim of the examiner. With his skill as a radiographer, should be combined intelligence, good judgment, careful manipulation and attention to details, experience, and a fundamental knowledge of anatomy and the science of medicine. Radiographs of this kind must be anatomically accurate in order to portray the exact condition of affairs.

An uncertain method of diagnosis is useless and even dangerous. In interpreting the skiagraph, the examiner must have in his mind the exact conditions present at the time of the examination, in order to make the proper deductions from the details shown by the skiagraph. For example, it is necessary to know the posture assumed by the patient at the time of the exposure, the positions of the tube and the plate and the bulk of the stomach contents. Without a knowledge of such details, an erroneous interpretation of the radiograph is likely to result. It is quite possible, when examining a patient in the recumbent posture, to obtain a skiagraph showing no ptosis of the stomach, whereas another plate made with the same individual in the erect posture would reveal a considerable degree of ptosis. It would be quite impossible to interpret the first skiagraph correctly, for the purpose of diagnosing the presence or absence of a possible gastroptosis, without a knowledge of the posture of the patient at the time of the exposure.

The primary object of a radiographic examination of a case of suspected gastroptosis is to determine the presence of the ptosis, if it exists, and its degree. This, however, is not the limit of the knowledge to be derived from such examinations. A radiographic study of the subject of gastroptosis, based upon the observation of a large number of skiagraphs of normal and supposedly normal stomachs and of stomachs with all degrees of ptosis and dilatation, reveals many points of value not evident to the casual observer. It shows that the skiagraph, if properly interpreted and correctly made, will not only indicate with precision the size, shape and position of the stomach as an important addition to clinical evidence or in confirmation of a clinical diagnosis, but it also may reveal possible factors in the etiology of the condition, or suggest the appropriate therapeutic measures, and it will frequently demonstrate the anatomical results of treatment.

The radiographic method of diagnosis in gastroptosis depends for its accuracy upon the careful observation of the details of three important factors, namely:

1. The preparation of the patient.
2. The technique of the examination.
3. The correct interpretation of the skiagraph.

1. The preliminary preparation of the patient, when any is

required, should receive attention, because it may influence the final results, or it may have some important connection with one or more of the procedures of the examination. Therefore the examiner should be previously consulted, and any directions he may give should be considered and followed. When the examination is to be made of the stomach only, such directions usually relate to the food contents. There are no fixed rules for the preliminary preparation of cases of this kind. It is important that the examiner should have some knowledge of the clinical data in connection with all such cases sent to him before he makes the examination, and should be given some idea of the information he is expected to furnish, as his methods may be influenced more or less thereby. Likewise, he should be apprised of any unusual features of the case. For example, it might be advantageous or desirable, though not absolutely necessary, to introduce a stomach tube, when such a procedure might be unwise or contraindicated.

2. The technique of the examination depends largely upon the views and methods of the operator, but it has a close relation with his individual skill in deriving accurate and useful conclusions. He employs no secret methods, as he is sometimes accused of doing, nor must he be gifted with any extraordinary amount of skill. But equally as important as his personal requirements is the possession of suitable apparatus. Inferior equipment will not yield results which will be uniformly accurate or of the greatest diagnostic value which is always possible in each case. Further details of the technique will be referred to later.

3. A correct interpretation of the radiograph is equally as important a factor in rendering an accurate X-ray diagnosis as is the picture itself. In all of the more complicated skiagraphic examinations, such as many of those of the thorax and abdomen, it is advisable, and in fact essential, that the plates should be studied from two points of view, namely: that of the radiographer and that of the physician or surgeon referring the case. Such examinations should be considered in the light of consultations, and he who refers his cases for X-ray examinations should, therefore, be more or less familiar with such skiagraphs at least as those which pertain to his own particular variety of cases.

For a clearer understanding of the nature of skiagraphs of

the stomach it will be necessary to refer briefly to a few of the more important points concerning the technique of such examinations, especially when they are made for the purpose of determining the relative position and size of the organ.

Posture.—In an examination for gastroptosis, it is desirable to determine the extreme degree of ptosis which is possible and likely to be present at one time or another. Therefore, during such examinations we should attempt to imitate or have present, if possible, such conditions as are likely to induce the greatest deviation from the normal position. The standing posture allows the stomach to drop lower than any other, and is, therefore, the important one to be assumed by the patient, though radiographs may be made in any other positions that may be desirable. Examinations in the erect posture practically imply that the skiagraphic appearance of the stomach will not be confirmed in every respect at the time of operation, if the case comes to the operating table, because the empty and collapsed stomach and the recumbent posture then necessary are the reverse of the conditions at the time of the X-ray examination. Likewise, the results of a physical examination in the recumbent posture will usually differ materially from those of the radiographic examination with the patient standing. Standing is preferable to sitting, because the relations of the bony landmarks are apt to be changed in the latter position, whereas these relations should be as nearly uniform as possible in all examinations. Then, too, in cases with extreme degrees of gastroptosis a view of the entire pelvis is desirable, and this is not possible when the patient sits.

Position of the Plate.—The most important skiagraph of the stomach in cases of gastroptosis is the one made with the plate in front of the patient, because the greater part of the organ is nearer to the anterior than to the posterior abdominal parietes, and the definition of the shadow is better and the errors of projection less the nearer the object is to the plate. Also, the outlines of the stomach as brought out by physical examinations are determined on the anterior aspect of the abdomen.

Respiratory movements should cease during the radiographic exposure. Although it has been demonstrated in a sufficient number of instances to be conclusive that the position of the ptosed

stomach, or at least that of the greater curvature, during the erect posture, is influenced very little by respiration, there is, nevertheless, some movement, which is sufficient to prevent clearly defined shadows, both of the stomach and of the skiagraph as a whole. A ptosed stomach is less likely to be influenced by respiratory movements than one in the normal position.

Length of Exposure.—Aside from the fact that most radiographers hold that short exposures are productive of better results than are long ones, there are three adverse factors which become operative during long exposures, but do not become effective if the time is 10 or 12 seconds or less. These are respiratory movements, peristaltic movements, and movements of the body. A radiographic examination made while the patient holds his breath implies a short exposure. Peristaltic movements rarely interfere with the details of the shadows in 10 seconds or less. Patients are seldom able to stand very long, even if supported, without some slight movements of the body, even though they may not be conscious of the fact that they are moving.

The Phase of Respiration.—The necessity of a cessation of respiratory movements during the exposure has been discussed. As the difference in the position of the greater curvature of a ptosed stomach is so slight during full inspiration and forcible expiration as to be disregarded, the phase during which the exposure is made would seem unimportant. The essential point is for the patient to have sufficient air in his lungs to enable him to hold his breath for the required time. Unconscious muscular movements are likely to occur if the inspiration be too full.

Landmarks and Position of the Tube.—To determine the exact relative displacement or size of a stomach by means of the radiographic shadows, it is necessary to adopt certain landmarks, which can be regarded as uniform, and at the same time, are likely to maintain normal relations to other parts. In the radiograph, the shadows of all the structures in many different planes of the body are combined in one vertical plane. This renders it impossible to make comparative localizations upon the abdominal parietes. Therefore, we are not able to demonstrate the positions of the various organs in their relations to the anterior surface of the abdomen, as is the case in examinations by clinical methods. The

only available skiagraphic landmarks are those bony points which are both prominent in the picture and easily recognized upon the surface of the body. Some definite point on the skin surface, such as the umbilicus, may be selected, and by placing some opaque object, such as a coin, over it, its position will be indicated upon the plate by the shadow of the metal. The umbilicus has, in fact, been employed more or less uniformly as the important landmark for comparative measurements, although its use for this purpose may frequently become a source of considerable error, as will be shown later.

All of the rays which strike the plate and project the shadows thereon, emanate from a central point which is the target of the X-ray tube, and which we may imagine as the apex of a pyramid whose base is the plate. Therefore, only those structures which are in close proximity to the perpendicular from the target to the plate will cast a shadow which indicates their exact relative size and position. It follows that the further any structure is from this perpendicular, and also the further it is from the plate, the greater will be the error of projection of its shadow, and vice versa. Therefore a uniform central landmark should be adopted, and it should be as near to the plate as possible. It should also be in the horizontal plane of the perpendicular between the target and the plate, or in other words, the tube should be placed at such a level that its target will be in the same horizontal plane as this point. It is not always possible to have this landmark in the same vertical plane as the perpendicular, nor is it necessary, but the deviation should not be great. It is from such a point that we make our comparative vertical measurements in gastroptosis, allowing for the error of projection, of course.

As previously stated, the position of the umbilicus has been used with more or less uniformity as this landmark. An examination of the accompanying diagrams will show that the umbilicus is a very variable point, and that it is especially apt to be abnormally low in patients having gastroptosis. Therefore it is not a suitable landmark on the skiagraph for purposes of accurate measurement, nor the proper guide for the position of the target of the X-ray tube. A better level for the target would be the horizontal plane two inches above that of the anterior superior spines. Also,

from these points, which are plainly visible in the radiograph, accurate comparative measurements for determining degrees of ptosis can be readily made. The umbilicus should be indicated on the plate however. Its position in relation to the anterior superior spines will be correct because all three of these points are in the same plane and are in contact with the plate, when it is anterior. When measurements are made from the position of the umbilicus, allowance must be made for any abnormality in its position, which may be recognized by observing its relation to the fixed bony points. The localization of any particular part of the stomach should be determined by measuring on the skiagraph from the shadow of the nearest bony point as the anatomical relations exist in the body. For example, the position of the tip of the xyphoid may be indicated on the plate in the same manner as the umbilicus, but this is not the point on the skiagraph from which to reckon the situation of the pylorus. The pylorus is much nearer to the spine, and the shadows of the vertebræ are the proper skiagraphic landmarks. These details may seem superfluous, but they are mentioned because all of these points are so frequently overlooked and their importance underestimated by the majority of casual observers, and even by many X-ray examiners.

In a number of our examinations we have attempted to indicate the position of the tip of the ensiform cartilage on the skiagraph. This has been done, as in the case of the umbilicus, by fastening a small coin upon the patient's body at this point. We have noticed that there was more or less difficulty in locating the tip of the ensiform in most cases of gastroptosis. Not until recently did it occur to me to associate this difficulty, evidently due to the abnormally acute costal angle, with the peculiar anatomical deformities of this part of the body, described by various authors as a part of the symptom complex of gastroptosis.

Introduction of the Bismuth.—The quantity of bismuth introduced, the particular preparation or salt employed, and the manner of introducing it, are all points which require due consideration, but they are governed largely by the particular circumstances attending the case under examination and by the personal views or fancies of the examiner. The subnitrate is the preparation which is perhaps most generally used. Its only objectionable feature, which

is not shared by the subcarbonate, is its likelihood of poisoning some individuals. This may be obviated, however, by proper precautions. In the few instances in which we have used the subcarbonate its shadow did not seem to be as dense as that of the subnitrate, though the decided difference may have been due entirely to other causes. As large quantities of bismuth must be administered in order to obtain satisfactory shadows of the stomach, the powder cannot be given in its dry state. A suitable mechanical suspension answers the purpose very well, but in any of the liquid vehicles which can be used, the heavy powder will settle in a few minutes if the mixture is allowed to stand. In connection with nearly all of our cases we have used a freshly and carefully prepared suspension of the subnitrate in mucilage of acacia. Many radiographers prefer to incorporate the bismuth powder in some article of food, which is a very satisfactory way of administering it. There is a peculiar form of the subcarbonate which is a definite chemical compound existing in the form of a permanent chemical and physical suspension. It is probably a chemical mixture of the hydroxide and the subcarbonate suspended in water. Its form would render it a very convenient preparation for our purposes, but there is not sufficient bismuth in its composition to produce a satisfactory shadow of the stomach in most instances, although we have been able to make several satisfactory intestinal skiagraphs with it.

Our undesirable experience of several serious cases of poisoning, following the retention of large doses of bismuth subnitrate, makes the mention of this danger important as a warning to others. So far as we know, toxic symptoms are associated with the subnitrate only. Of course it is to be inferred that anyone, before giving to a patient such a large dose of bismuth as must be used for this purpose, will be absolutely certain that the preparation he intends to administer is free from any contamination with poisonous substances, especially arsenic, which is the most common of the dangerous impurities. Careful investigations in connection with our cases in which toxic symptoms were manifest have led us to believe that toxic manifestations, such as those observed in these instances, are due to the absorbtion of *nitrites,* which are liberated during some peculiar decomposition of the subnitrate in the intestinal

tracts of some individuals, but not all. The results are serious enough to demand care in the administration of comparatively very large doses of this otherwise apparently inert drug. Experience seems to prove that one ounce of this salt of bismuth may be safely retained, but more than this amount should never be allowed to remain in either the stomach or bowel. If more than this quantity must be used, all or part of it should be removed as soon as possible after the completion of the examination. Haste is especially necessary when a suspension of bismuth is introduced into the stomach, because in this form it is permitted to pass through the pylorus very rapidly, and almost immediately.

The Contents of the Stomach.—It seems rather peculiar that such an important consideration as the volume of the contents of the stomach at the time of an examination to determine its position, and even its size, is a point which is so very frequently overlooked or disregarded. The amount of bismuth used has a bearing only upon the qualities of the radiograph, and neither the weight of the drug nor the bulk of the vehicle should be confused with the amount of the stomach contents. There should be some mutual understanding among radiographers as to how much the stomach should contain at the time of an examination for any particular purpose, but there is no uniformity in regard to this point in the technique among the different X-ray specialists. The procedure followed in the examination of our cases at the present time is to make the examination for ptosis and dilatation soon after the patient has eaten a comparatively large meal, waiting a few minutes to allow the bismuth to mix with the food before making the exposure. Under such circumstances the examination is made in the presence of natural conditions in each individual case.

A comparative radiographic study of over one hundred cases of gastroptosis examined within the past year and a half has shown that there is much more knowledge to be derived from the individual skiagraph than the mere determination of the position and size of the stomach. Although very few of such distinct pathological conditions as are classed as separate and distinct diseases of the stomach can be diagnosed directly by the radiographic examination alone, nevertheless, considerable miscellaneous clinical data of extreme value may be derived. At the present time the

range of the application of the X-ray examination of the stomach is limited practically to the determination of the following conditions:

(1) Abnormalities in position, such as ptosis.
(2) Abnormalities in size, such as contraction or dilatation.
(3) Abnormalities in shape, such as the " hour glass " stomach.
(4) Abnormalities in motility.
(5) Retention.

Retention and lessened motility, or even its absence, can by no means be used as synonymous terms. A lessened degree of motility of course finally results in retention, but the skiagraph will usually reveal the presence of additional factors in the causation of the latter condition. For example, in the moderately dilated stomach of the " sagging " type, the appearance alone implies lessened motility, because this type is the result of a stretched and weakened muscular wall. In the erect posture, such a stomach hangs like a thin rubber bag filled with water, with the outlet or the pylorus some distance above the most dependent portion. By the laws of physics, such a stomach cannot empty itself without considerable muscular effort, which it lacks the power to exert. Retention is a logical sequence, but is not the result of lessened motility. These facts would seem to refute any statement to the effect that marked retention is always the result of pyloric obstruction. On the other hand, in the tubular type the relative position of the pylorus is found frequently to be comparatively low, and if this be the case, even though such a stomach be dilated, and its motility lessened, retention is not a prominent feature, although the less its muscular power, the slower will the organ be able to empty itself. In the absence of the conditions of dilatation and lessened motility in the tubular stomach, we may have hypermotility. Such causes of retention are plainly revealed by the skiagraph.

If, however, retention is not the result of such simple mechanical factors, but of actual organic pyloric obstruction, then the skiagraph has practically no value in the diagnosis of the cause. Simple mechanical causes of retention, such as dilatation, or a pyloric kink, are easily recognized in the skiagraph, though they may not always be discovered in a clinical examination. On the other hand, no dependence can be placed upon the X-ray examina-

tion to confirm the presence of malignant or cicatricial stenosis, for a radiograph yielding indisputable evidence of either of these conditions is most exceptional. However, in such cases, the presence of the condition is usually readily determined by clinical methods. Some of the results of organic pyloric obstruction, such as dilatation, are recognizable.

It is possible that obstruction of this kind may exist for a short time before dilatation becomes manifest, but only as long as the motor apparatus is fully equal to the task of emptying the stomach. When the effort fails, dilatation must follow, because of the resulting retention and the increasing weakness of the musculature.

In studying such skiagraphs as are required in the examination for gastroptosis, one's powers of observation should be trained to look further than for the mere position, size, and shape of the stomach. If the search is made, such points may be revealed as the position of the pylorus, the presence or absence of a pyloric "kink," the positions of the liver, of the spleen, and of any portion of the colon which may happen to be outlined. Any or all of these points may have some bearing upon the case.

One of the most noticeable features of ptosed stomachs to be observed when making a collective radiographic study of gastroptosis is the tendency they all have to follow certain distinct types. We have found it possible to classify our cases in such a manner that practically every one of them conforms to a prominent type, and as a result, the study of the subject has been simplified. This classification is based upon the position, shape, and the general appearance of the stomach, when examined in the erect posture. In no other position which the patient may assume is it possible to demonstrate with assurance by means of the skiagraph either the presence or the absence of gastroptosis, or the exact degree of ptosis, if any exists.

In this classification five distinct types of gastroptosis are recognized, and for convenience we have added as a sixth type the anatomically normal stomach. The classification is as follows:

(1) The normal stomach.
(2) The transitional type of gastroptosis.
(3) The anatomical type.
(4) The tubular type.

(5) The sagging type.

(6) The dilated type.

(1) The normal stomach is included as a type in this classification, primarily for convenience of comparison with the other types, and secondarily, because familiarity with a few of the anatomical relations of the normal organ is essential in order to properly interpret the skiagraph of a case of gastroptosis. The important points to remember in the latter connection are, first, the correct position of the stomach, as recognized by anatomists, and confirmed by the skiagraph; secondly, the normal relations of those portions of the stomach the positions of which are altered in gastroptosis; thirdly, the structures which are responsible for the maintenance of the normal position of the stomach, and which are directly or indirectly associated in the mechanism of ptosis; fourthly, the intimate anatomical relations of those surrounding organs or structures which may be associated in some manner with gastroptosis; and finally, the shape and the size of the normal stomach.

I. The *direction* which the stomach takes when it lies in its normal anatomical position is somewhat variable (see Figs. 1 to 3), and it may vary under natural conditions even in the same individual. Its general tendency is to lie obliquely and nearer to a horizontal than a vertical direction, the difference in the levels of the two extremities preventing what might be regarded as a true horizontal position.

II. The *cardiac end* is never concerned in the mechanism of ptosis, as it is practically a fixed point, because of its direct continuation from the œsophagus and its secure attachment to the diaphragm and other surrounding structures. From a clinical standpoint its position may be designated in connection with certain points on the anterior surface of the body, but skiagraphically, its only anatomical relation which can be considered is its position on the left side of the eleventh dorsal vertebra. The *pylorus* is one of the two important portions of the stomach the positions of which are materially altered in ptosis of the organ. In connection with gastroptosis it is always found to be displaced either downward or to the left, or in both directions. Its normal position is on a level with the first lumbar vertebra. Laterally, its position may

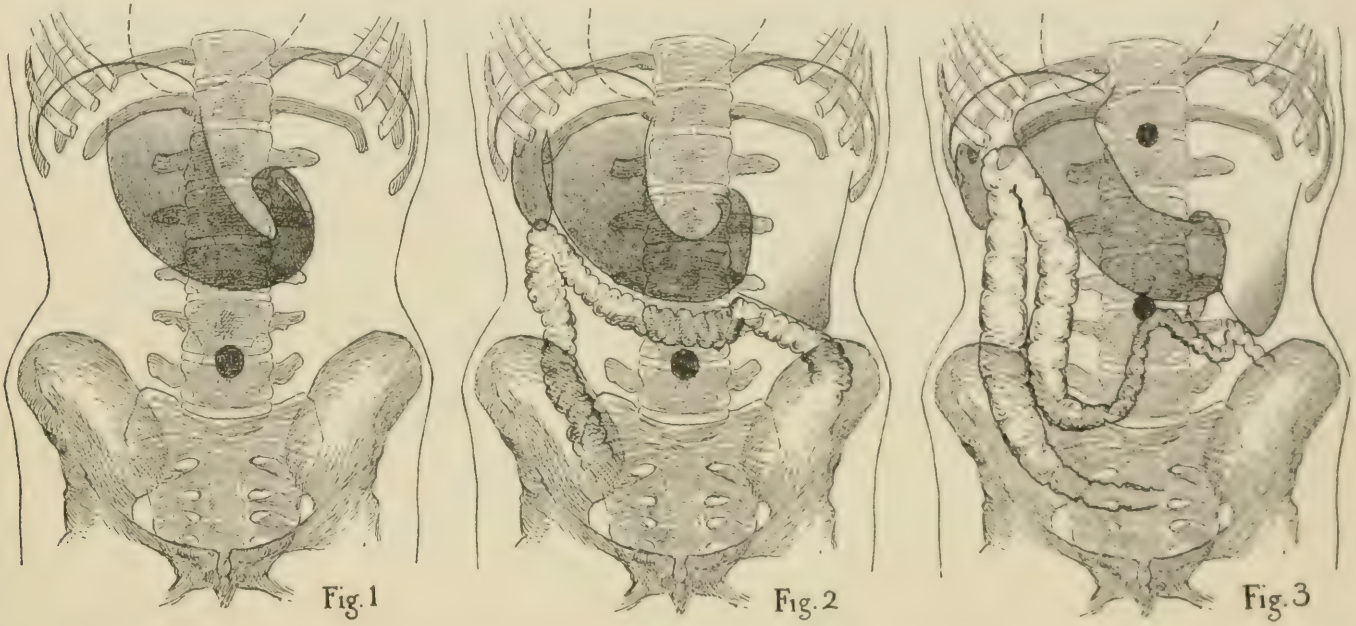


Fig. 1.—Normal stomach. This was one of the few cases in which gastroptosis was at the least suspected, and was not found, the stomach being apparently perfectly normal in every respect, skiagraphically.

Fig. 2.—A stomach apparently normal, skiagraphically, in every respect. This is rather surprising, as the patient had been previously operated upon for ptosis of the sigmoid, with post-operative adhesions. There is also a slight ptosis of the entire colon, but especially of the hepatic flexure and the right half of the transverse colon, and a slight ptosis of the liver. The ptosis of the colon is not so evident because of the low position of the umbilicus. This emphasizes the mistake made in using this point as a landmark for this purpose. Both stomach and large intestine contain bismuth.

Fig. 3.—Practically a normal stomach as to its shape and size, and also its position, except that the pylorus is situated slightly lower than normal. This deformity is slight in view of the decided ptosis of the left half of the transverse colon and the slight ptosis of the hepatic flexure and the liver. Both stomach and large intestine contain bismuth.

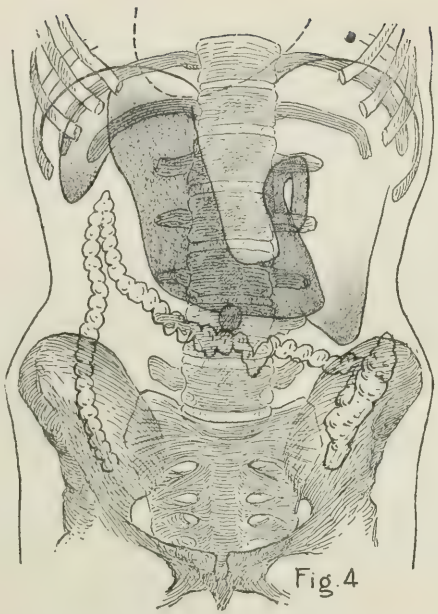


Fig. 4

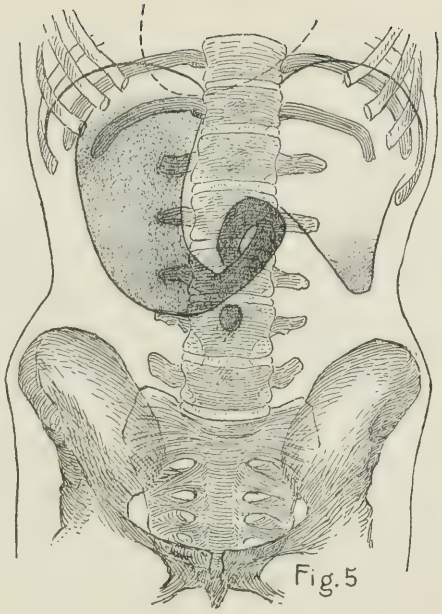


Fig. 5

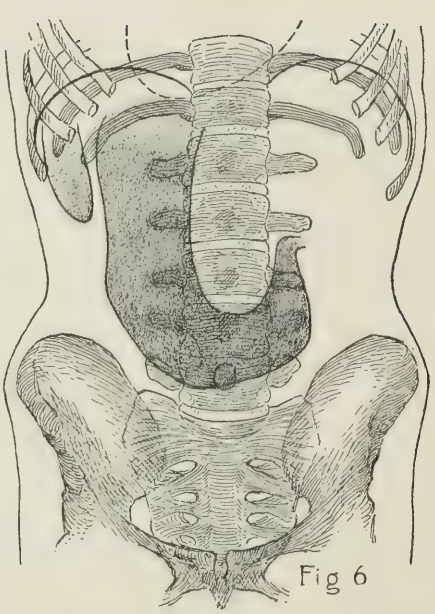


Fig 6

Fig. 4.—This stomach may be considered normal, although the greater curvature is slightly lower than usual. The pylorus is normally situated, and the slight ptosis of the two flexures and the transverse colon may be concerned in the lowering of the greater curvature of the stomach. Obstruction in the sigmoid was suspected in this case, and the bismuth in the large intestine was administered by mouth 18 hours before the examination.

Fig. 5.—This stomach represents an actual type of gastroptosis. Anatomically, its position is normal except that the pylorus is a little too low. The important feature is the *vertical position* of the upper two-thirds. This is a factor sufficiently important to class the position as one of ptosis. This type probably represents the *first stage* of gastroptosis, but it is not a stage in which symptoms should arise from the condition directly. This might conveniently be termed the "*Transitional Type.*" One or both of two factors would be necessary to change this type to one of true anatomical or pathological gastroptosis:—a lowering of the pylorus, or a loss of muscular tone, which would be associated sooner or later with dilatation.

Fig. 6—In this stomach the pylorus has dropped to a lower level than in the preceding case, and the ptosis, though quite moderate, is distinct. This may be termed the "*Anatomical Type*" of gastroptosis. In this type, ptosis is unquestionable from an anatomical standpoint, but the degree is moderate, and the patients have either few or slight symptoms, or none at all, referable to the gastroptosis directly. In this case there were no symptoms whatever, and the stomach was examined because the patient thought he had swallowed some of his teeth. Stomachs of this type may become dilated or pass into either the "*Tubular*" or the "*Sagging*" type. There may be some dilatation in this case, but the absence of marked dilatation and the relatively high position of the pylorus prevent the absolutely vertical position found in the tubular and sagging types.

vary from a point somewhat to the right of the mid-line to as much as two inches to the right, depending upon the amount of distension of the stomach. It lies more anterior than the cardiac extremity. As the pylorus has a complete peritoneal covering and is possessed of a considerable range of motion, it would seem rational to assume the possibility of an exaggeration of this range of motion. Whether this is the case, or whether the pyloric attachments are abnormally low under the existing circumstances, it is conclusively proven by the skiagraph that the pylorus is invariably to be found at a lower level in the presence of gastroptosis. It has been observed, in some instances, to lie as low as the fifth lumbar vertebra. The status of the firmly fixed portion of the duodenum in such instances is as yet rather doubtful. There seems to be reliable authority in recent literature for us to assume the existence of such a condition as a congenital low pylorus. This would have to be associated of course with more or less of a degree of gastroptosis, also congenital. We would expect a ptosis of this kind to conform more or less to the anatomical or to the tubular type. Granting the existence of such a condition, it is hardly likely that there would be any symptoms associated with it, unless the same factors became operative as are concerned in the mechanism of a pathological gastroptosis, and changed the congenital ptosis into an acquired one. A congenitally low pylorus is not altogether a satisfactory explanation for the extremely low position in which this part of the stomach is sometimes found in gastroptosis. It is quite likely, however, that all doubts in connection with this particular point will be removed in time, for the X-ray examination of the stomach is still in its infancy, and there is a great deal yet to be learned from it.

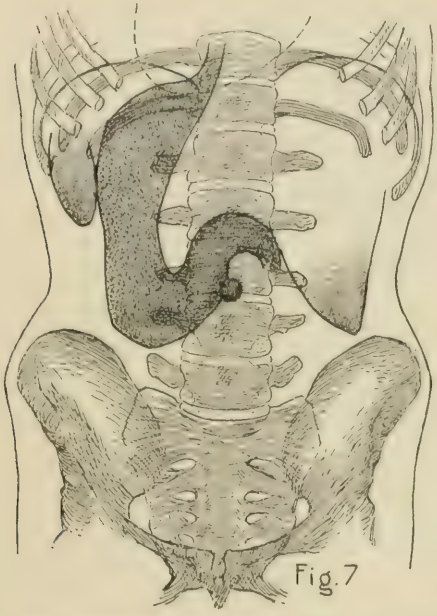
The *greater curvature,* in the skiagraph of the normal stomach, is found to lie at a variable distance above the level of the lower border of the third lumbar vertebra, but in extreme ptosis it may drop almost to the level of the sympliysis pubis.

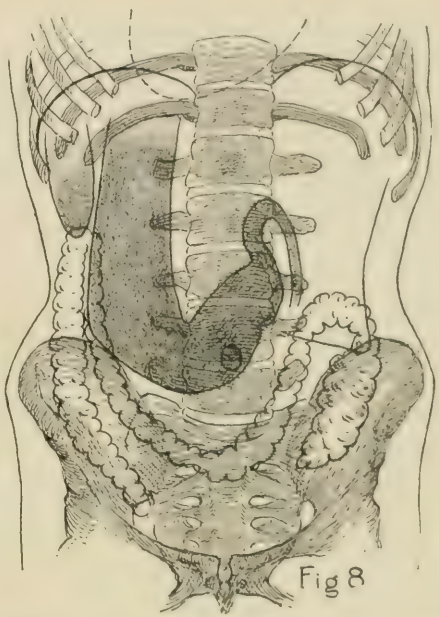
III. Aside from its cardiac attachments, the main support of the stomach is the gastro-hepatic omentum. Relaxation or stretching of this suspensory ligament is one of the most important factors in the mechanism of gastroptosis. If this structure fails in its mission, the performance of its duty falls upon the pyloric attachments, with the possible result of a pyloric "kink."

IV. As the stomach lies directly under the liver, and is suspended in part from it, it follows that either a ptosis or an enlargement of the liver will have some influence upon the position of the stomach (see Fig. 65). The relations of the stomach and the transverse colon are such that each may influence the position of the other under certain conditions imposed by a ptosis of either.

(2) The "transitional" type. Although the identity of this type is not well supported by the results of our observations, and its necessity is somewhat doubtful, it has nevertheless been of service in representing those cases in which the very earliest stage in the development of gastroptosis may be observed. At such a period, the condition would be practically unrecognizable except by means of the X-ray examination, and would give rise to no symptoms. Figure 5 represents an example of this type. In this case the vertical position of the stomach is the most noticeable feature of ptosis to be noted, while the slight displacement of the pylorus and the evidence of some degree of relaxation of the gastro-hepatic ligament may be recognized as factors present in the mechanism of gastroptosis.

(3) The "anatomical" type. Most X-ray specialists who have made many examinations for gastroptosis, have, no doubt, at some time in their experience, been almost led to a conviction that an individual who possessed a normal stomach was the exception rather than the rule. Such an impression is not unjustifiable when we consider the fact that most cases sent to us for such examinations are those in which there is more or less reason for suspecting that gastroptosis exists. A careful study of the whole subject from the radiographic standpoint will clear away all doubts in this connection, however. The trouble has been, not with the skiagraph, for its revelations are truthful, but because we are not able to interpret what it shows properly. Undoubtedly gastroptosis, in the strict sense of the meaning of the term, is present in a great number of instances when there are no subjective manifestations or clinical evidences of its existence. In such instances it is not strictly pathological, and its discovery may not even be possible by any clinical methods. Such a ptosis is to be regarded as relative only, or as we have classed it, "anatomical." The anatomical type may be either a premonitory stage of a true pathological ptosis,





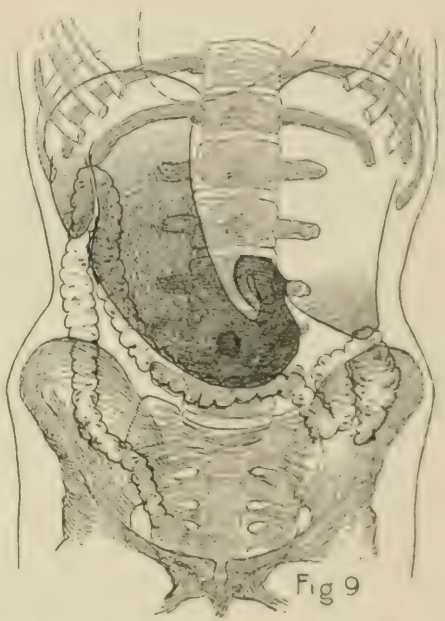
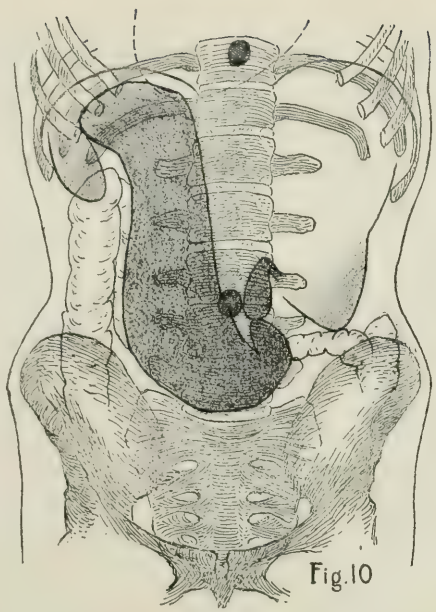
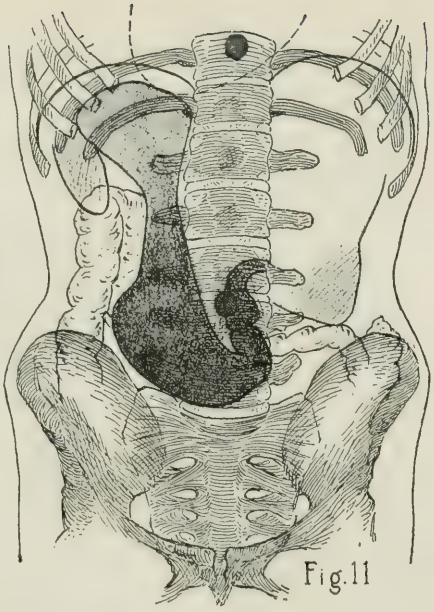


FIG. 7.—Anatomical type, in which, as in the preceding case, the pylorus is lower than normal, but in addition, it lies further to the left side, and allows the stomach to take a more vertical position. This was a case in which pyloric obstruction was suspected, but the fact that the skiagraph shows that a considerable quantity of the bismuth has escaped into the small intestine in the short interval of 18 minutes between its administration and the examination would seem to indicate that if any obstruction is present, it cannot be of a marked degree.

FIG. 8.—Anatomical type, in which the pylorus remains relatively high and the deviation from the transitional type is due to other causes. In the first place, there is some dilatation. Moreover, there is a marked ptosis of the transverse colon, which is most likely either a factor in causing the gastroptosis, or both conditions are due to the same cause. The pylorus remains well over to the right side, otherwise it is likely that in connection with such a relatively high pylorus there might be a marked pyloric "kink." The pyloric third of this stomach is rather more dilated than is usually found. Both stomach and large intestine contain bismuth.

FIG. 9.—Anatomical type, in which the important factor in evidence is the low pylorus. The liver is somewhat ptosed, and this may be a factor in allowing the stomach to drop downward and to the right, or there may be a redundant gastro-hepatic ligament. In size, this stomach, though apparently relatively large, is probably about normal, as the bismuth was introduced purposely after a large meal, and allowed to mix with the food. Some resemblance to the normal shape and direction of the stomach is preserved because the pylorus returned to the right side. This patient had no symptoms referable to the position of the stomach. This diagram is a composite of the skiagraph of the stomach and another of the colon made 24 hours later, after the bismuth had passed through into the large intestine. There is a ptosis of the hepatic flexure, with a resulting redundancy and loop.





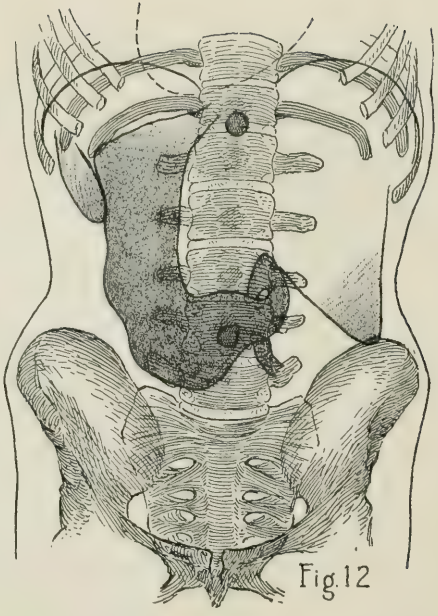
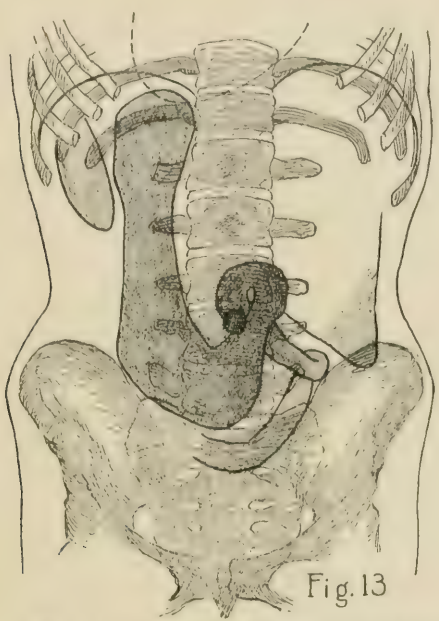
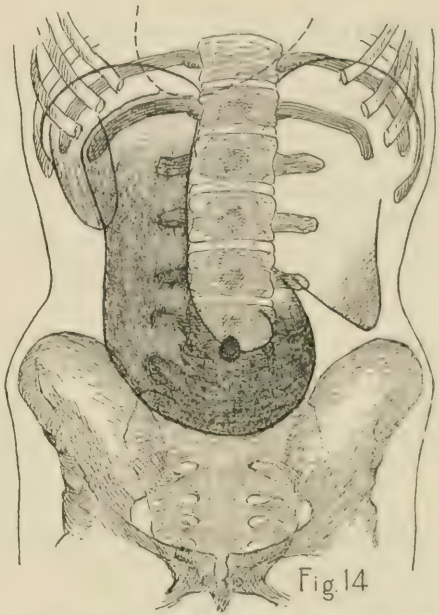


Fig. 10.—Anatomical type, in which the degree of ptosis is greater than in the preceding cases. The pylorus is low, but with this degree of ptosis, it is "relatively" high, thus producing a pyloric "kink." This patient had marked gastric symptoms, and these may be ascribed, in part at least, to the kink. The liver must have been a factor, as this patient had a "corset liver," which appears both ptosed and turned. In view of such a condition of the liver, it would seem likely that the ptosis of the stomach is not dependent solely upon a redundancy of the gastro-hepatic ligament, because it does not drop vertically. The hepatic flexure and right half of the transverse colon are ptosed.

Fig. 11.—From a skiagraph of the same patient, made just before the preceding one, but when the stomach contained but one-third of the quantity of bismuth. Although there is no difference in the degree of ptosis revealed, this is one instance which proves the possibility of error arising from lack of care in regard to the quantity of the contents in a stomach when examined for ptosis or dilatation.

Fig. 12.—Anatomical type, with moderate ptosis, and in which one would suspect, from the position of the stomach, that a redundant gastro-hepatic ligament was a factor. The pylorus is low actually, and relatively, very low, so that there can be no kink, particularly with the stomach in such a position. In this case, as in many of the tubular type, in which the stomach is vertical and well over to the left side, and the pylorus low, there is hypermotility.





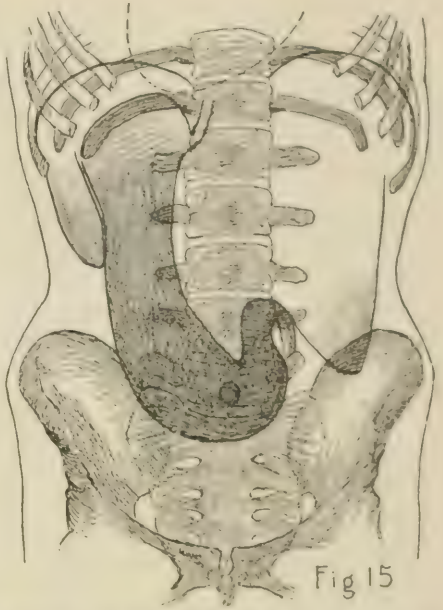


FIG. 13.—Anatomical type, with vertical stomach, moderately ptosed, and low pylorus. The liver appears to be ptosed, but as this patient, as was discovered later, had a syphilitic hepatitis and pancreatitis, part at least of this downward displacement is due to enlargement. The skiagraph was made to throw light upon an obscure diagnosis rather than because gastroptosis was suspected. The moderate ptosis present was not responsible for the patient's symptoms. The enlarged and ptosed liver is doubtless a factor in the displacement of the stomach. The skiagraph gives evidence that the stomach is pushed over to the right, and perhaps downward, by a colon enormously distended with gas. In such a stomach, with vertical position, with a normal tonicity of its muscular coat, and with a low pylorus without a kink, we have the factors for hypermotility, and such is evidently the case, judging from the rapid escape of the bismuth into the small intestine. So rapidly did the bismuth leave the stomach, that the skiagraph is not indicative of the actual size, and perhaps not altogether of the exact shape of the organ.

FIG. 14.—Anatomical type, and rather a marked ptosis, considering the age of the patient, a girl of 17 years. The pylorus is low, but its exact position could not be determined because of the dilatation and the small quantity of bismuth used. A stomach tube could not be passed for its removal. A subsequent operation revealed a ptosed "U" shaped stomach, as shown in the skiagraph, complicated by a partial obstruction in the colon due to adhesions between the ascending colon and hepatic flexure. A gastro-enterostomy was performed, and the colon freed of its stenosing adhesions. There was marked gastric retention in this case.

FIG. 15.—Anatomical type, with the pylorus extremely low for this type. With the liver so markedly ptosed, it is presumable that the gastro-hepatic ligament must be holding the stomach up, otherwise it would tend more to the tubular type. The ptosis of the liver is a likely factor. The spleen is considerably ptosed.

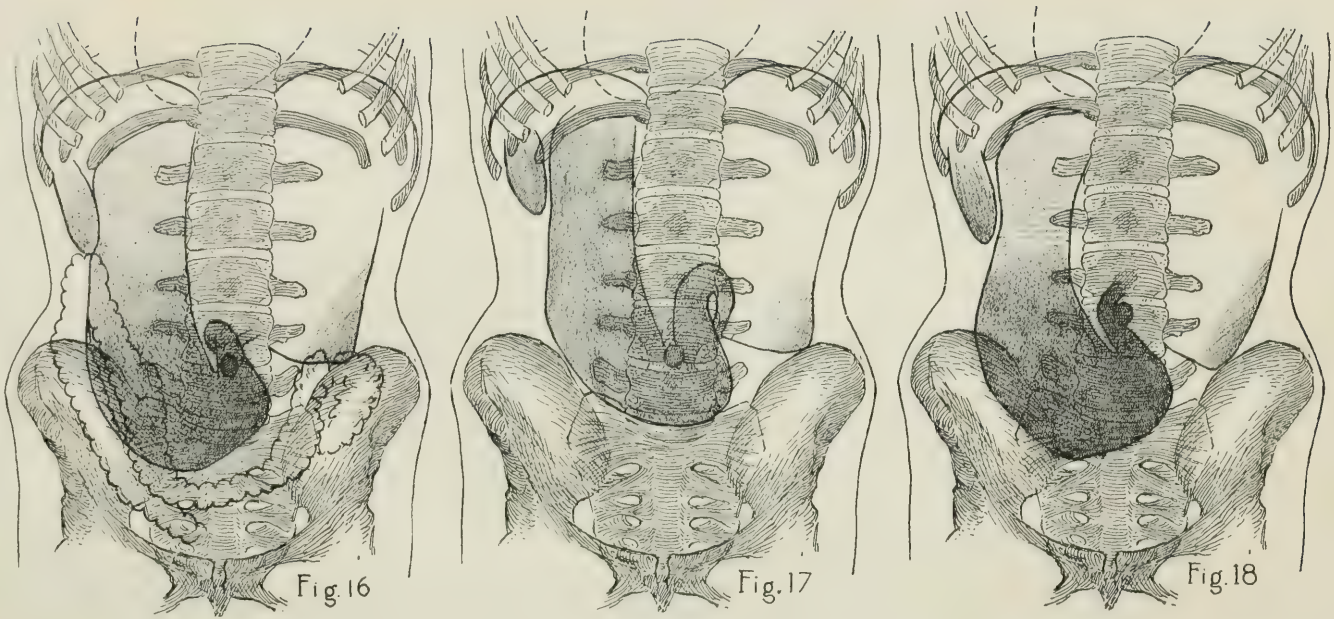


Fig. 16. Anatomical type, associated with a general visceroptosis, the skiagraph showing, in addition to the gastroptosis, a ptosis of the liver and spleen and of the entire colon. The pylorus is exceedingly low, both anatomically and relatively, and seems to be displaced to the left side. There is no kink. The position of the stomach is vertical. This is an extreme degree of ptosis of this type. Both stomach and colon contained bismuth.

Fig. 17.—Anatomical type, in which the ptosis is evidently due largely to the dropping of the pylorus and relaxed gastro-hepatic ligament. Ptosis of the liver may be a factor. Clinically this stomach was capable of moderate dilatation, and from the skiagraph we may account for this by the pyloric kink. There was also clinical evidence of periodic pyloric obstruction, which was explained clinically by spasmodic contraction due to either chronic ulcer or hypersensibility of the pyloric region. There were no symptoms pointing directly to gastroptosis, though this would explain most of them.

Fig. 18.—Anatomical type, in which the degree of gastroptosis, and also the ptosis of the liver, are practically the same as in the preceding case. The appearance of the stomach differs, however, in two noticeable features:—(a) The position of the pylorus is more to the left making the kink still more sharp. (b) The lower half of the stomach is more dilated, showing a tendency to approach the sagging type.

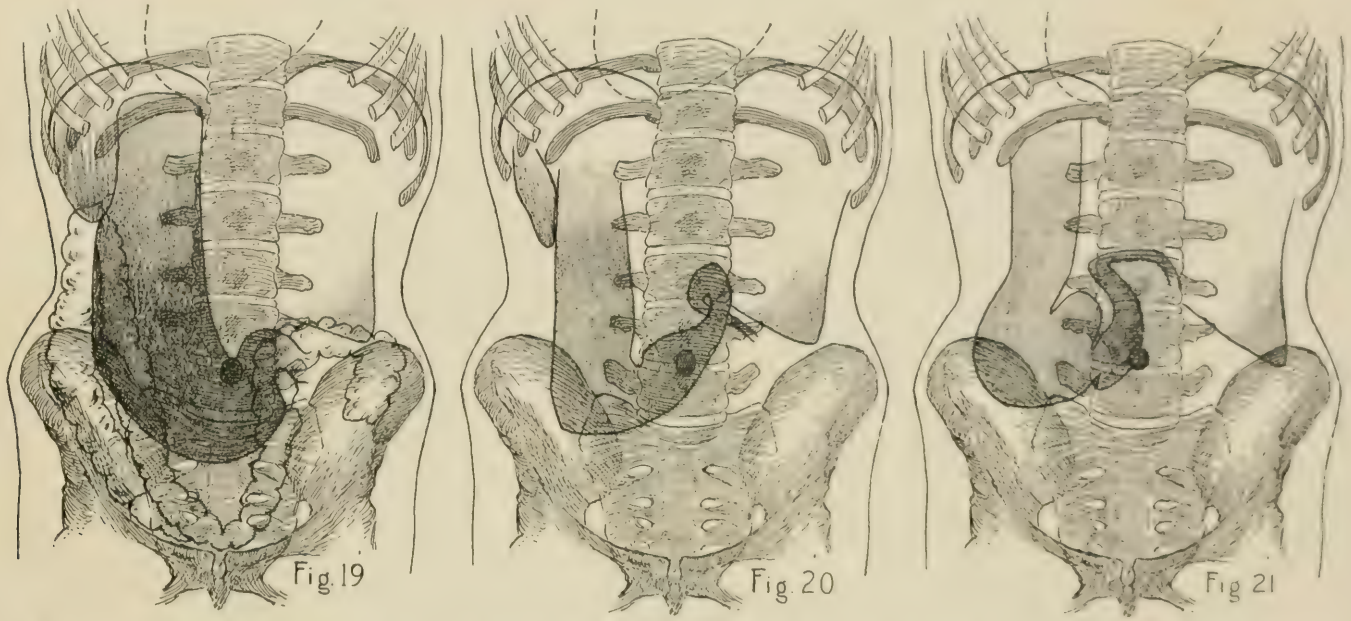


Fig. 19.—Anatomical type, with dilatation. The gastroptosis, which is extreme for this type, has been considerably increased by the dilatation. This case might be more properly included, perhaps, in the *dilated* type. That the gastroptosis, and not the dilatation, is the condition of primary importance is shown by the associated moderate ptosis of the spleen, liver, and hepatic flexure of the colon and the extreme ptosis and redundancy of the transverse colon. The pylorus is very low, both anatomically and relatively but situated well over to the right side, all of which prevent a kink. The gastro-hepatic ligament and position of the pylorus on the right side evidently have prevented a complete vertical position of the stomach. Symptoms were marked in this case, but could not be ascribed altogether to the gastroptosis and dilatation, because of the associated extreme ptosis of the transverse colon, which must have been a factor in increasing the degree of gastroptosis. This diagram is a composite of two skiagraphs, the first of which was made after the introduction of bismuth into the stomach, and the second, two days later, after a bismuth enema.

Fig. 20.—Anatomical type, with moderate ptosis. The gastro-hepatic ligament has evidently allowed the stomach to assume a vertical position. The pylorus is moderately low anatomically, but relatively, it is high, and lies well over to the right side, thus preventing any marked kinking. By comparison with Figs. 13 and 14, it will be noted that the conditions are, in the main, very similar, except that in this case the pyloric third is partially contracted and nearly empty. Were this portion full, as in most of the preceding cases, some kinking might be produced.

Fig. 21.—Anatomical type, with moderate ptosis, differing from the preceding case mainly in the position of the pylorus more to the left side. This, together with a redundant gastro-hepatic ligament, permit the vertical position of the stomach. The liver is considerably ptosed.

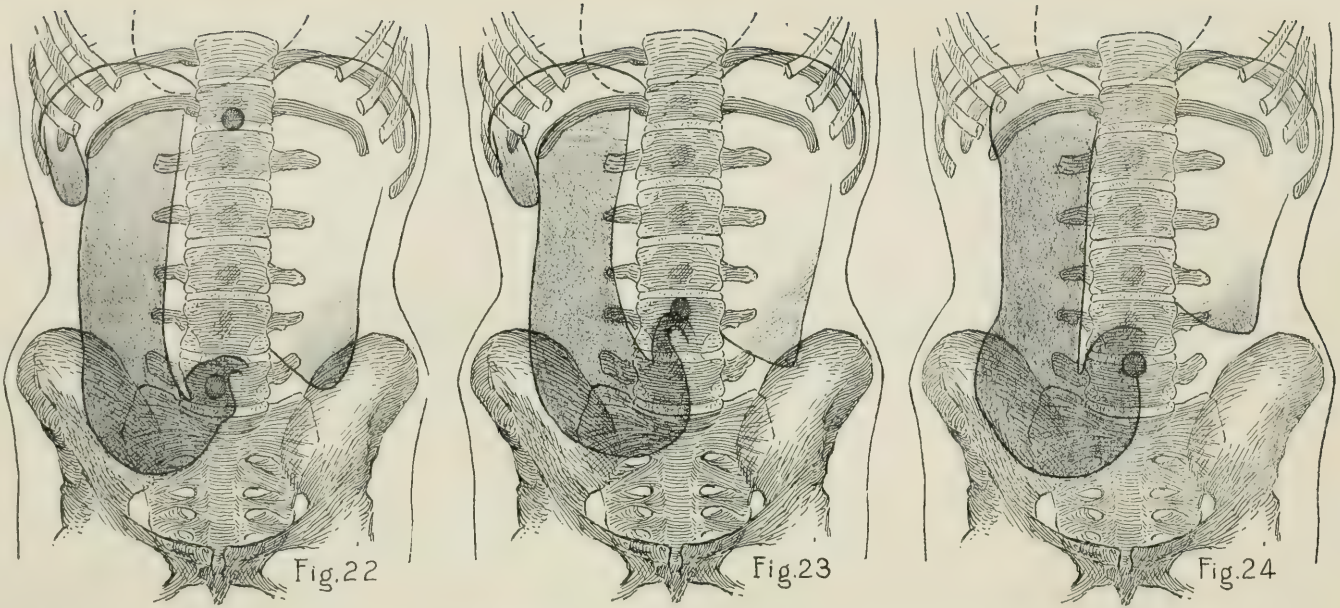


Fig. 22.—Typical example of the *Tubular* type of gastroptosis, in which the stomach assumes a true vertical position, with a moderate degree of ptosis, and without any tendency to sag. The pylorus is very low, both anatomically and relatively, and, although situated too far to the left, there is little or no tendency toward kinking. Dilatation is moderate. The gastro-hepatic ligament and the low pylorus are the evident and important factors, while in addition, in this case, the ptosis of the liver may share some of the responsibility. Compare this diagram of the skiagraph made before the application of a binder with the next, which represents the skiagraph made after a binder was applied. The contents of the stomach were the same in each instance.

Fig. 23.—The same case, after application of an adhesive plaster binder. Although the symptoms were greatly relieved thereby, it will be noted that the degree of gastroptosis is unchanged, because the effect of the binder has been support, and not to shorten the gastro-hepatic ligament nor to materially raise the pylorus. The only results noticeable are as follows:—1. The umbilicus has been elevated several inches because of the support to the relaxed and dependent abdominal walls, thus making the stomach appear even lower, when taking this point as a landmark. This is an example of the error of using the umbilicus as a landmark routinely. 2. The liver has been slightly elevated. 3. The pylorus has been elevated slightly, with a consequent alteration in the shape of the dependent portion of the stomach. 4. The pyloric third has been raised slightly.

Fig. 24.—Tubular type, with slightly greater degree of ptosis, and slight relative dilatation of the pyloric third. The pylorus occupies the same position, comparatively, as in the preceding case, but its median position, its dilatation, and the comparatively greater degree of gastroptosis all tend to develop a kink. The gastro-hepatic ligament and the low pylorus are evidently the important factors.

or the result of some anatomical abnormality, which is hardly to be considered a pathological defect, such as a lack of the normal support from a slightly relaxed gastro-hepatic ligament, or a rather widely movable or unusually low pylorus; or the stomach may be pushed down by a ptosed or enlarged liver; or displaced by a distended colon; or dragged down by a ptosed transverse colon.

There is little doubt but that the liver, when enlarged, and especially when ptosed, can influence the position of the stomach to some extent, but not to such a degree as to be considered a direct factor in the production of a pathological degree of gastroptosis. In the minor degrees, as represented by the anatomical type, it may, however, be concerned directly in the mechanism. Just how frequently this happens we have been unable to determine, but one case (Fig. 65) has afforded exceptional opportunity for a study of this particular point. Before operation the ptosis was of the sagging type. By the operation, one of the two primary factors was completely removed by the shortening of the relaxed gastro-hepatic ligament; the other was partly removed by the partial replacement of the displaced pylorus; while a third factor, only secondarily so, however,—the dilatation,—still remains. But even without the latter ptosis would still persist. Here is a case in which we know that gastroptosis of a relative or anatomical type is due almost entirely to a ptosis of the liver, which prevented a return of this stomach to its normal position. That the ptosis still remaining after the operation is not distinctly pathological is shown by the absence of symptoms at the present time; by the fact that the ordinary clinical examination fails to reveal the presence of any marked degree of ptosis; and by the fact that the skiagraph shows that the position of the stomach is as nearly normal as is possible for it to be under the circumstances.

The important characteristics of the anatomical type are a moderate degree of ptosis of the stomach, as indicated by the position of the greater curvature; a change from the normal horizontal position to one more nearly vertical; and more or less downward displacement of the pylorus, with or without displacement to the left. In addition, although the radiograph does reveal the unquestionable existence of gastroptosis, and a clinical examination may do so also, symptoms directly referable to this condition are

either absent altogether, or are few in number and slight in degree of severity, unless dilatation alone is the etiological factor.

(4) The "tubular" type. In this type the two important factors directly concerned in the mechanism of the ptosis are a low pylorus, which is clearly demonstrated by the skiagraph, and a probable relaxation of the gastro-hepatic ligament, which must be deduced from the general relations of the structures as revealed by the radiograph. The pylorus is usually displaced more or less to the left, and is always found at a very low level anatomically, and relatively low as compared to the stomach as a whole. The viscus assumes a distinctly vertical position, and is typically tubular in shape, without any tendency toward sagging. The degree of ptosis is always marked, and may become extreme. Such a stomach may or may not be dilated, but extreme dilatation is not the rule, which may be on account of the invariably low position of the pylorus. Symptoms referable directly to the condition are always present, and their severity may be extreme.

The characteristics of this type are the marked ptosis, the low pylorus, and the uniformly tubular shape of the stomach.

(5) The "sagging" type. In this type the two direct primary factors in the mechanism of ptosis of the preceding type are also operative, but they are reinforced by the additional one of dilatation, which, through a stretching and weakening of the muscular coat, permits the stomach to sag downward in the erect posture from the weight of its contents in the most dependent portion. Therefore dilatation is always present. The appearance is similar to that of a condom filled with water and suspended from its top. The position is vertical. The amount of displacement of the pylorus varies greatly, and it may be found extremely low. Retention is favored and the pyloric "kink" is likely to be produced, especially when the pylorus is relatively high compared to the level of the most dependent portion of the fundus. A relaxed gastro-hepatic ligament is particularly to be inferred in the presence of a kink. Symptoms are always prominent and severe.

(6) The "dilated" type. In this type dilatation is the predominating feature. Although the ptosis may still conform in some respects to one of the preceding types, still the dilatation may be so extreme as to destroy all resemblance to any of them.

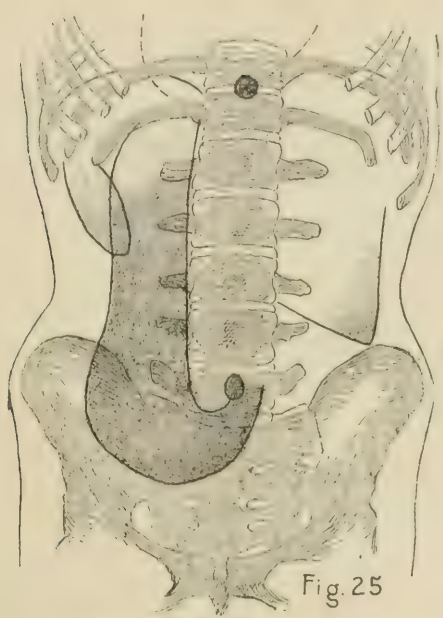


Fig. 25

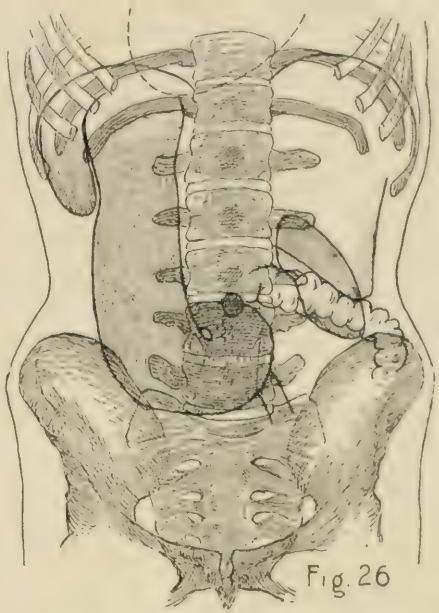


Fig. 26

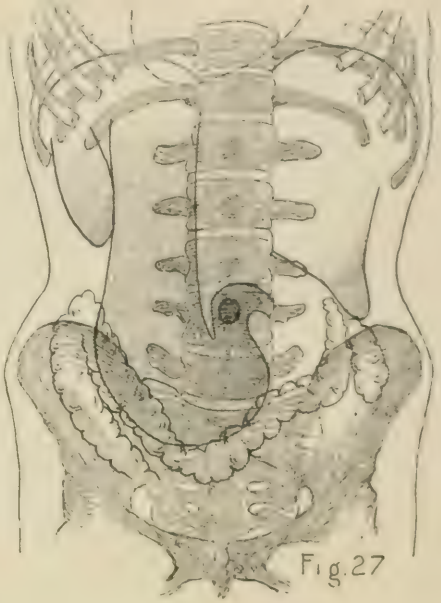
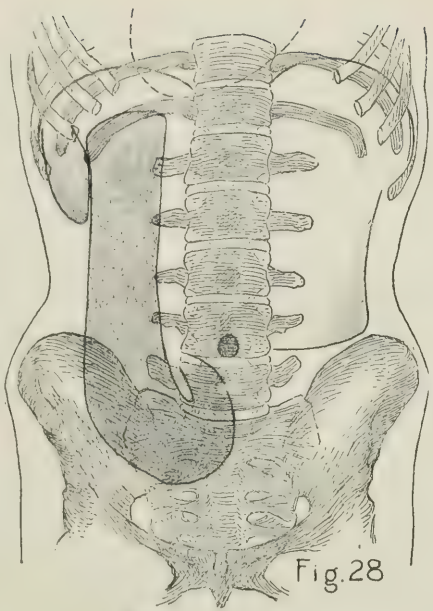


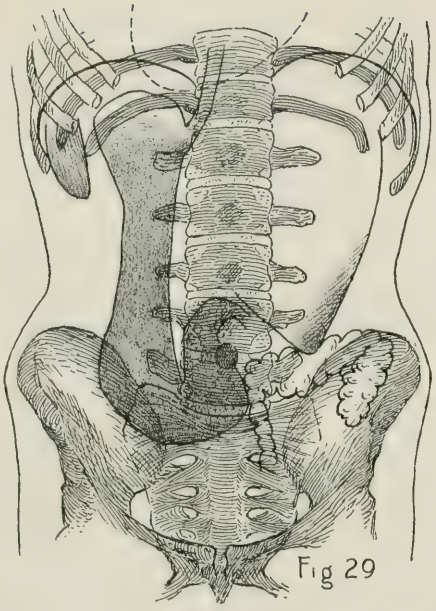
Fig. 27

Fig. 25.—Tubular type, in which the essential factors are evidently the gastro-hepatic ligament and the very low pylorus. As the latter is also found well over to the right side, there is no kink. There is considerable dilatation, but this enters directly into the causation of the extreme degree of ptosis. The dependent abdominal wall is indicated by the low position of the umbilicus. The liver is moderately ptosed but the spleen is considerably lower than normal.

Fig. 26.—Tubular type, with moderate ptosis. This might be classed under the anatomical type were it not for the situation of the pylorus and the confirmatory skiagraphic evidence of the clinical manifestations of a general visceroptosis, as shown by the additional moderate ptosis of the liver and spleen and the extreme ptosis of the right kidney. The pylorus is relatively and anatomically low, and too far to the left. There is no direct evidence of a kink. Evidently the gastro-hepatic is a factor of importance. This diagram is a composite of two skiagraphs, one of the kidney region and the other of the stomach after the introduction of bismuth.

Fig. 27.—Tubular type, with moderate ptosis, and slight tendency to sag from dilatation. The pylorus is anatomically low, but relatively moderately high, and too far to the left, with slight kinking. There is an associated ptosis of the liver, spleen, and *entire* colon. It is unusual to find such an extreme degree of ptosis of the splenic flexure as this case presented, and it is therefore possible that this condition is a factor in the gastroptosis, together with the gastro-hepatic ligament and the low pylorus. There was either normal or *hyper* motility, judging from the fact that all of the bismuth administered 15 minutes after a full meal, when the first skiagraph was made, was found to be in the colon 6 hours later, when the second exposure was made. This diagram is a composite of the two radiographs. The symptoms in this case were largely neurasthenic. Evidently the slight kink was not a detriment to motility.





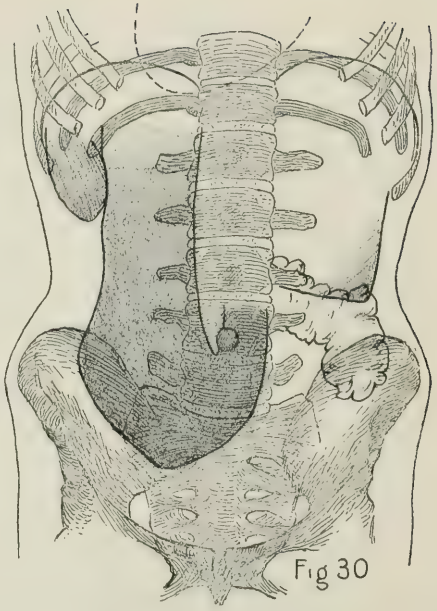


Fig. 28.—Tubular type, with extreme ptosis and moderate dilatation. The pylorus is very low, both anatomically and relatively. Its abnormal position to the left side creates a tendency toward kinking, but the kink is not sharp. The entire stomach is displaced to the left of the median line. The position of the pylorus and relaxation of the gastro-hepatic ligament are distinctly the factors of importance. The liver is moderately ptosed, and by its displacement, is a factor in the gastroptosis by pushing the pylorus either down or to the left, or both. The spleen is slightly ptosed.

Fig. 29.—Tubular type, with moderate ptosis, in a young girl aged 15 years. Clinically this was diagnosed and reported as a case of phantom tumor, but the clinical phenomena were in reality probably due entirely to the gastroptosis and associated conditions. The stomach is more or less compressed and pushed to the right by gaseous distension of the colon. The pylorus is very low anatomically, but moderately high relatively, and displaced to the left, with a resulting sharp kink. There is an acutal ptosis of the liver, which appears to be instrumental in pushing the pylorus downward and to the left. The gastro-hepatic ligament is doubtless at fault also. The hepatic flexure and transverse colon are ptosed, being indicated in the skiagraph by the contained gas. The spleen is not ptosed. In view of the existing conditions especially the pyloric kink, dilatation is likely to result later in this case with a change to the sagging type.

Fig. 30.—Tubular type, with moderate ptosis, but marked dilatation, and with a tendency toward sagging. The pylorus is low anatomically, but moderately high relatively, with a tendency toward kinking, although there is no actual sharp kink. The liver and colon are not ptosed, but the colon is distended with gas, especially the hepatic flexure. The spleen is moderately ptosed.

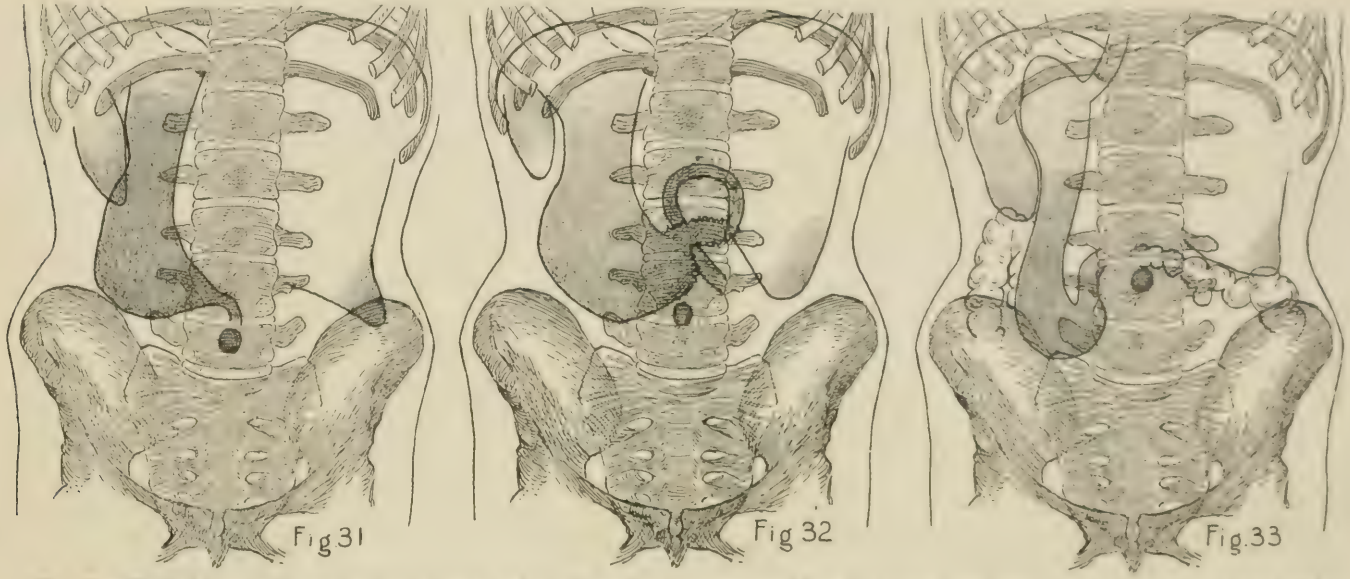


Fig. 31.—Tubular type, with very moderate ptosis, and much less than was suspected from the clinical manifestations, as the symptoms were marked. The stomach is vertical, and the pylorus is extremely low anatomically, and lower relatively than in any other case examined. It is also displaced to the left. The displacement of the pylorus is the essential feature in this case. There is no dilatation, and the normal shape of the stomach is more or less preserved. The shape and position of the stomach and the displacement of the pylorus are not indicative of retention, and in reality, hypermotility would be expected, unless there was pyloric obstruction (organic or spasmodic) or muscular insufficiency, either of which would be associated with dilatation. Pyloric obstruction was suspected clinically, but there is no skiagraphic evidence of this in retention with dilatation or of mechanical obstruction by kinking. The gastro-hepatic ligament and the low pylorus are evidently the important factor in the gastroptosis. Further relaxation of the ligament, together with dilatation might produce a more typical tubular appearance later. The liver and spleen are considerably ptosed.

Fig. 32.—*Sagging* type, representing an early stage in the transition from anatomical type. There was clinical evidence of pyloric obstruction, probably carcinomatous. The skiagraph gives some slight evidence of the diagnosis, but it should not be accepted as having any positive value. In contrast with the preceding case, we have in this one the almost certain existence of organic pyloric obstruction, and its results are already evident. There is a slight degree of gastroptosis, which without the accompanying dilatation, would be of the anatomical type. The symptoms did not point to this condition. The pylorus is slightly ptosed anatomically, but relatively it is almost normal in position, vertically and horizontally. The liver is slightly ptosed, but there is evidently more or less relaxation of the gastro-hepatic ligament. The predominant feature is a beginning dilatation, still moderate in degree. This is the result of the obstruction, and if it has not been the cause of the ptosis, it has increased that already present. Further evidence of the dilatation and loss of muscular tone is shown in the tendency toward the sagging type of ptosis, in which dilatation is always the determining factor.

Fig. 33.—Sagging type. This diagram gives proof of the probability of error arising from the use of insufficient contents in the stomach for the production of correct results from skiagraphic examinations, except for certain special purposes. The total contents of this stomach was 6 ounces, and the skiagraph gives no correct conception of the exact degree of ptosis or dilatation possible. It is assumed that the ptosis is of the sagging type, but this may not be correct. We are able to determine an anatomically low, but relatively high pylorus, displaced to the left with more or less kinking which is not well brought out. There is slight ptosis of the liver, marked ptosis of the spleen moderate ptosis of the entire colon, outlined by the contained gas.

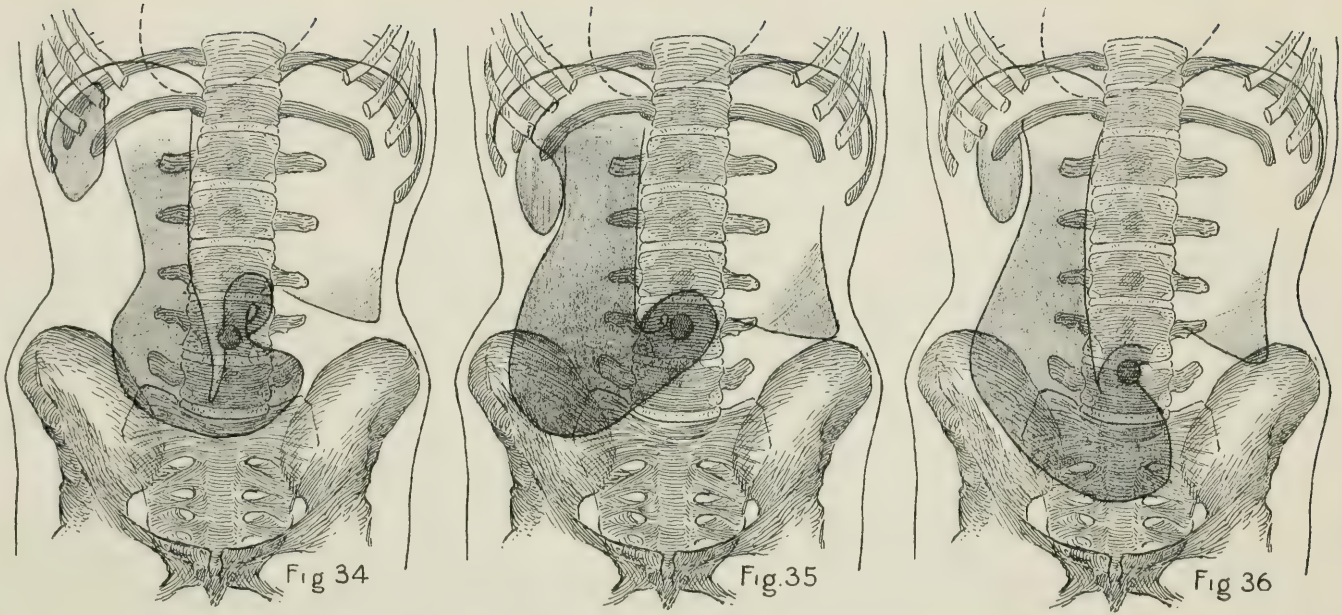


Fig. 34.—Sagging type, with moderate ptosis and dilatation. The pylorus is anatomically low, but relatively very high, and displaced slightly to the left. The resulting kink is very marked and sharp, and from its unusual situation it is evidently largely due to relaxation of the gastro-hepatic ligament. It is probably a factor of importance in the symptomatology in this case. The patient was a young unmarried woman of exceptionally good physique. The liver and spleen are slightly ptosed.

Fig. 35.—Sagging type, with moderate ptosis, and general dilatation becoming marked in degree, and associated with general visceroptosis. The pylorus is very low both anatomically and relatively, and is displaced to the left slightly. There is no evidence of kinking. The gastro-hepatic ligament and the low pylorus are primarily the essential factors in the ptosis, which is further increased by the dilatation.

Fig. 36.—Sagging type, with extreme ptosis and considerable dilatation. By comparison with the preceding case, it would seem probable that the greater degree of ptosis and the change in appearance of this case were dependent mainly upon the displacement of the pylorus further downward and to the left, and still more, even, upon a further decrease in the support afforded by the gastro-hepatic ligament. The essential differences lie in the position assumed by the lower portion of the stomach, the displacement of the pylorus with the appearance of a kink and a more decided sagging, with approximately the same degree of dilatation.

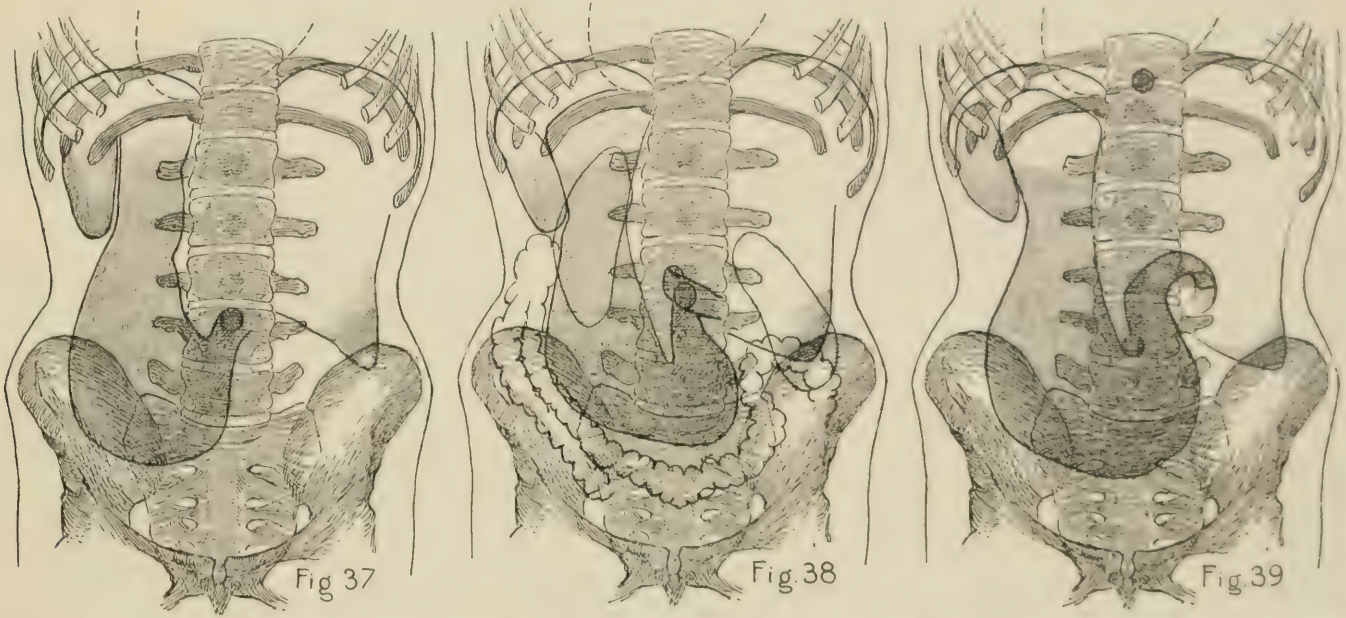
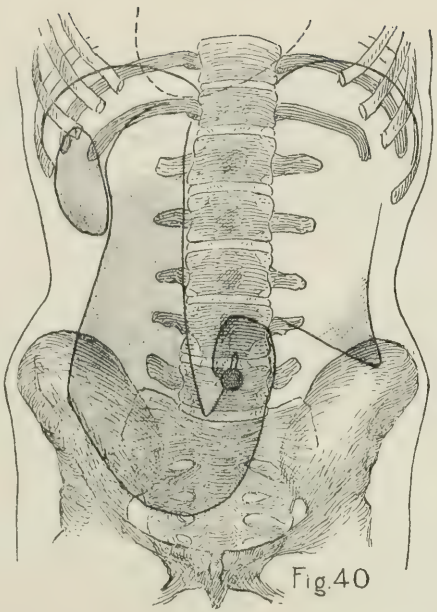
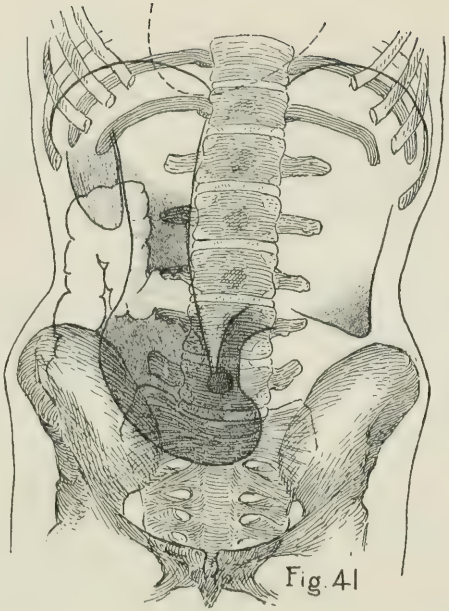


FIG. 37.—Sagging type, in which a marked dilatation is the determining factor in creating this type. Less dilatation would likely give the appearance of the tubular type. The pylorus is very low anatomically and would be relatively low except for the dilatation and its resulting ptosis. Under the circumstances, retention is favored. There is no skiagraphic evidence of kinking. The gastro-hepatic ligament and the displacement of the pylorus downward and to the left are primarily the factors in the ptosis, which is exaggerated by the dilatation. The liver and spleen are ptosed.

FIG. 38.—Typical example of the sagging type, with moderate ptosis and dilatation, associated with general visceroptosis. The pylorus is low anatomically, but relatively high, and displaced to the left, with decided kinking. The gastro-hepatic ligament and low pylorus are evident factors in the ptosis, with the addition possibly of the displacement of the liver. It is exaggerated by the dilatation. The entire colon is ptosed, and this may be an additional factor in the gastroptosis, but not necessarily so. In addition to the ptosis of the liver and spleen, there is a nephroptosis, especially of the right kidney. This diagram is a composite of 3 skiagraphs, one of the kidney region, one after introducing bismuth into the stomach, and the third after an enema of bismuth.

FIG. 39. Typical example of the sagging type, with a greater degree of ptosis, dependent upon greater general dilatation. The pylorus is moderately low anatomically, but relatively high, and not displaced laterally. The kink is marked, but not sharp, and is evidently permitted by the gastro-hepatic ligament, which, with the dilatation are the important factors in the degree of gastroptosis present. The ptosis of the liver is quite marked but of the spleen, moderate.





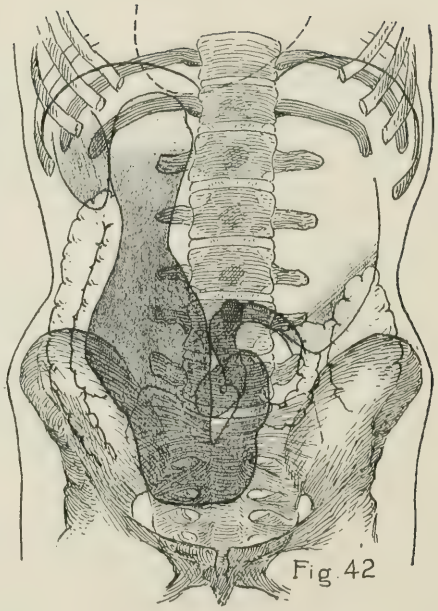


FIG. 40.—Sagging type, with extreme ptosis and dilatation. The pylorus is very low anatomically, but relatively high, and displaced to the left. The gastro-hepatic ligament is a very evident factor in the ptosis, and permits the marked though not sharp kinking. The low pylorus and the dilatation are the other factors in the extreme ptosis. The pyloric third does not seem to share in the general dilatation though it may be empty as a result of kinking. The shape and position of the stomach, aside from the dilation, favor retention.

FIG. 41.—Sagging type, with moderate ptosis and slight dilatation. The gastro-hepatic ligament is not sufficiently relaxed for the production of the tubular type, but is too much so for the anatomical type. There is slight dilatation of all but the pyloric region. The pylorus is anatomically low, but relatively high, and displaced to the left, permitting a kink. There was clinical evidence of pyloric retention. The left side of the colon is distended with gas, and evidently presses on that side of the stomach. The splenic flexure and spleen are slightly ptosed.

FIG. 42.—Sagging type, with moderate dilatation for the degree of ptosis present. The pylorus is very low anatomically, and moderately low relatively, with displacement to the left, and a tendency toward kinking. The pyloric region is not dilated. The ptosis of the liver is possibly a factor in the gastroptosis, but the gastro-hepatic ligament and low pylorus are the predominant factors. The transverse colon is moderately and the flexures slightly ptosed. Bismuth was introduced into both stomach and colon.

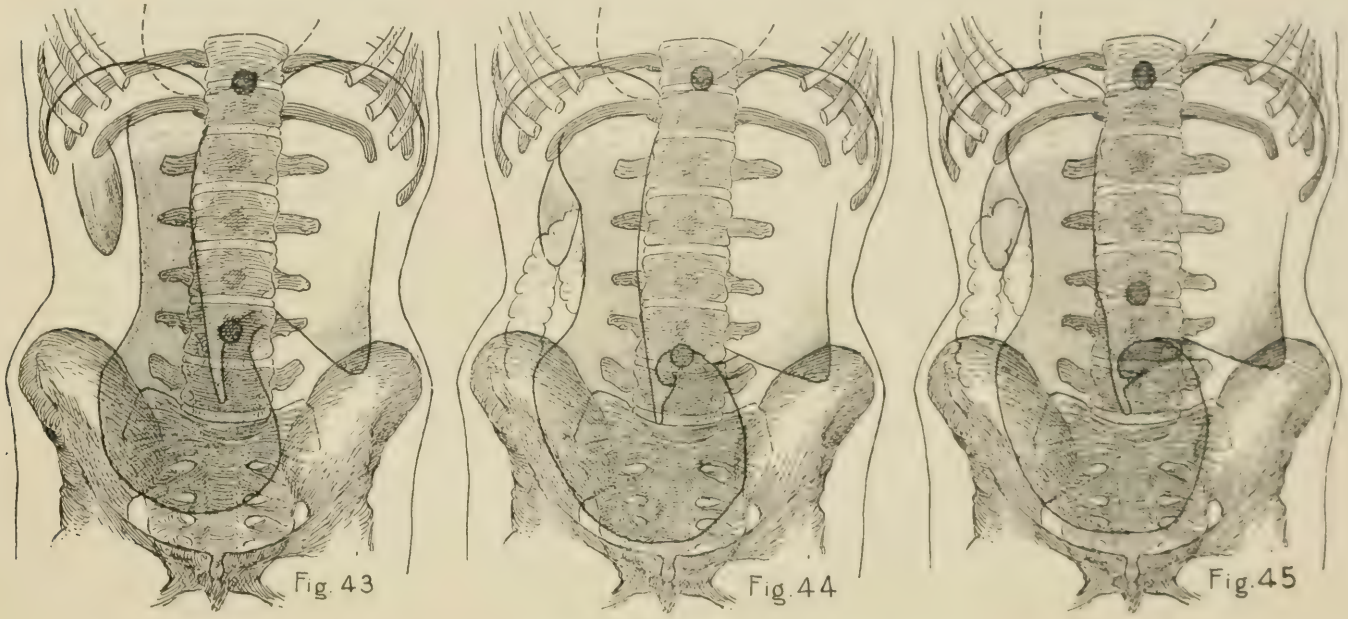


Fig. 43.—Sagging type, similar to Case 39, except for a greater degree of ptosis and less relative dilatation and a lower position of the pylorus.

Fig. 44.—Sagging type, with still greater degree of ptosis. The pylorus is lower, both anatomically and relatively, and displaced more to the left. Less kinking is apparent but it might be possible for the weight of the distended stomach to cause a kink at times. The dilatation is evidently the main factor in retention. Gastroptosis and dilatation are equally prominent, but that the former was primary is confirmed by the associated visceroptosis. This diagram represents the skiagraph made before the application of a binder.

Fig. 45.—The same case, after the application of an adhesive plaster binder. There is practically no change in relations, except that the umbilicus is raised to its normal position by the support of the pendent abdominal wall. The contents of the stomach were the same for each skiagraph.

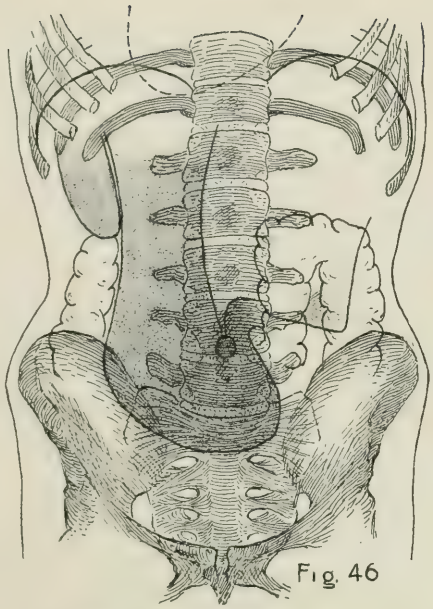


Fig. 46

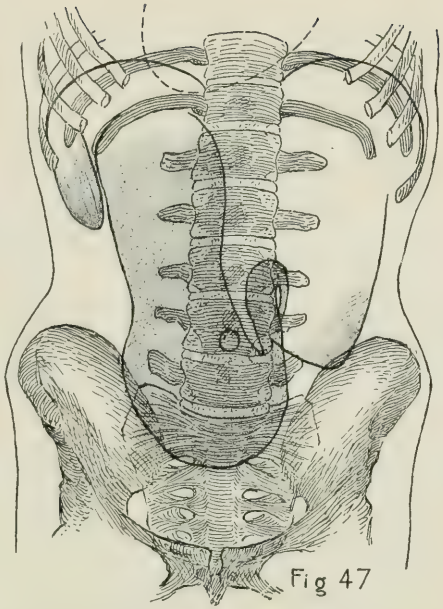


Fig 47

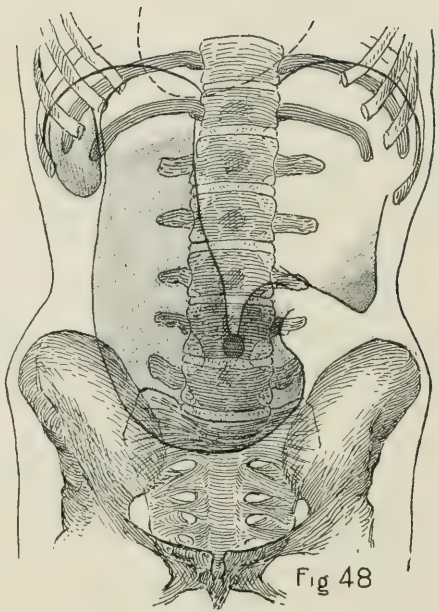


Fig 48

Fig. 46.—Dilated type, with moderate ptosis. This case might be classed as one of the anatomical type with associated dilatation, but it is classed with those of the dilated type because an acute dilatation was suspected clinically. Dilatation is easily demonstrated by the skiagraph, but will not determine whether or not it may have been acute. If this dilatation was acute, there is reason to believe that it was preceded by a certain degree of gastroptosis, because of the associated ptosis of the spleen and liver and of the transverse colon and splenic flexure, (which are outlined by the gas contained therein) and by the displacement of the pylorus downward and to the left, with slight kinking, and also by the vertical position of the stomach.

In cases of this type, dilatation is the more prominent feature, both skiagraphically and clinically, even though the skiagraphic appearance may indicate a dilated example of one of the other types.

Fig. 47.—Dilated type, with moderate ptosis of the anatomical type, associated with or perhaps due to a considerable degree of dilatation. Clinical manifestations of dilatation predominated. It is quite likely that the skiagraph does not demonstrate the extreme degree of dilatation possible in this case. The pyloric portion of the stomach is not distended. The pylorus is moderately low anatomically, but relatively high, and not displaced to the left, although in a distended normal stomach the pylorus usually moves more to the right. This may be prevented by the ptosis of the liver, but the gastrohepatic ligament is at least responsible for the kink, which is very marked. The kink and dilatation were responsible for the periodic attacks of retention. The skiagraph demonstrates a ptosis of the entire colon.

Fig. 48.—Dilated type, with moderate ptosis of the anatomical type. The pylorus is low anatomically, though moderately high relatively. The gastrohepatic ligament permits some kinking. Dilatation is the more predominant feature. Ptosis is permitted by the ligament and the low pylorus and is increased by the dilatation.

In addition to the data so far discussed, there is much additional help to be derived from the X-ray examination in gastroptosis. The more important points will be dwelt upon briefly:

Etiology.—There are many points in regard to the etiology of gastroptosis that may be learned from the skiagraph, but the X-ray method of examination is in no way concerned with the remote or the direct external causes. From the radiographic standpoint we have to deal with only such factors as are concerned directly in the mechanism of the ptosis. Each of the cases represented by the accompanying diagrams is fully discussed from this point of view in the appended legends. Those etiological factors in the mechanism which may be determined from the skiagraph may be enumerated as follows:

1. The position of the pylorus, which has already been given full consideration.

2. Relaxation of the gastro-hepatic ligament. There are many instances in which the skiagraph shows evidence of a relaxation of this support of the stomach. A vertical position of the organ, the existence of a comparatively open space between its shadow and that of the liver, and particularly the presence of a kink in the pylorus, would seem to be indicative of the lack of the proper support from this ligament.

3. Dilatation is easily determined, provided care is employed in the technique of the examination.

4. Relaxation of the muscular coat is suggested by the presence of dilatation, the sagging type of ptosis, and by lessened motility and retention, when they are not due to obstruction.

5. The influence which the position of the liver may exert in the mechanism of gastroptosis has already been discussed.

6. The presence of pyloric obstruction can be determined with any degree of certainty only when it is due to mechanical factors such as a kink. Rapid evacuation of a bismuth suspension would be indicative of the absence of obstruction.

7. Traction by a ptosed colon.

The degree of motility may be determined to a certain extent by the rapidity with which the bismuth, when mixed with the food contents, leaves the stomach. Additional points in favor of hypermotility and lessened motility may be suggested by the relative posi-

tions of the pylorus and the most dependent portion of the fundus. Lessened motility is to be inferred, as a rule, when dilatation is present.

Suggestions as to Treatment.—Undoubtedly in some instances the appearance in the skiagraph may offer some useful suggestions as to the most appropriate method of treatment. The degree of gastroptosis and the direct factors in the mechanism of the ptosis are the points to be observed in this connection.

The Results of Treatment.—The radiographic examination is a most useful and reliable means of determining the anatomical results derived from any particular method of treatment which may be employed.

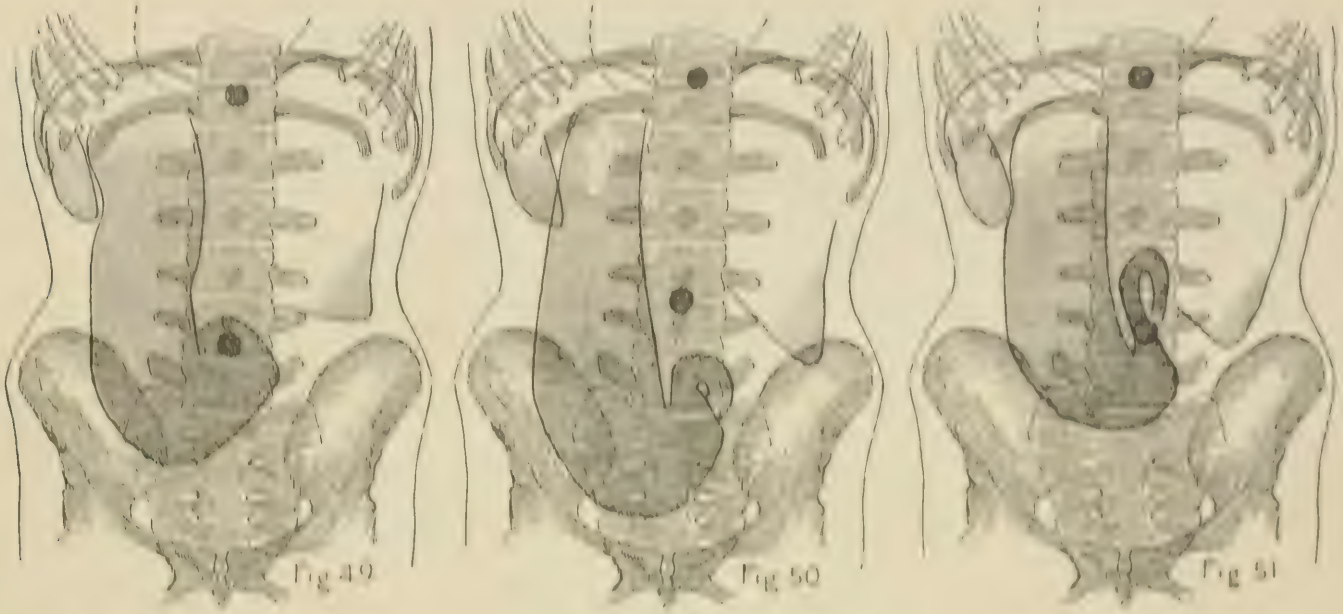


Fig 49 Fig 50 Fig 51

Fig. 49.—Dilated type with marked ptosis resembling the tubular variety and associated with dilatation, which is the more predominant feature. The pylorus is very low both anatomically and relatively and is displaced to the left. No pylorus kink is evident. The lieasment and the displacement of the pylorus are the important factors in the ptosis, which is increased by the dilatation. Among the important clinical manifestations were those of periodic retention, which may be explained by the dilatation alone, but may have been due also to some obscure kinking or other mechanical cause resulting from dilatation.

Fig. 50.—Dilated type with extreme ptosis resembling the tubular variety. The pylorus is very low anatomically and mechanically, low relatively, and displaced slightly to the left. There is a slight kink. The lieasment and the low pylorus are the essential factors in the ptosis, which is increased by the dilatation.

Fig. 51.—Dilated type with moderate ptosis resembling the tubular variety. The exact location of the pylorus is uncertain from the skiagraph. It may be very low anatomically and moderately low relatively, the loop being the duodenum, or it may be moderately low anatomically and very low relatively, with the pyloric third of the stomach contracted, and a marked kink occurring. It is displaced to the left in either case, and the lieasment is a factor in the ptosis. The position of the outlet of the stomach is a mechanical factor of sufficient importance to cause retention in itself. The liver and spleen are moderately ptosed.

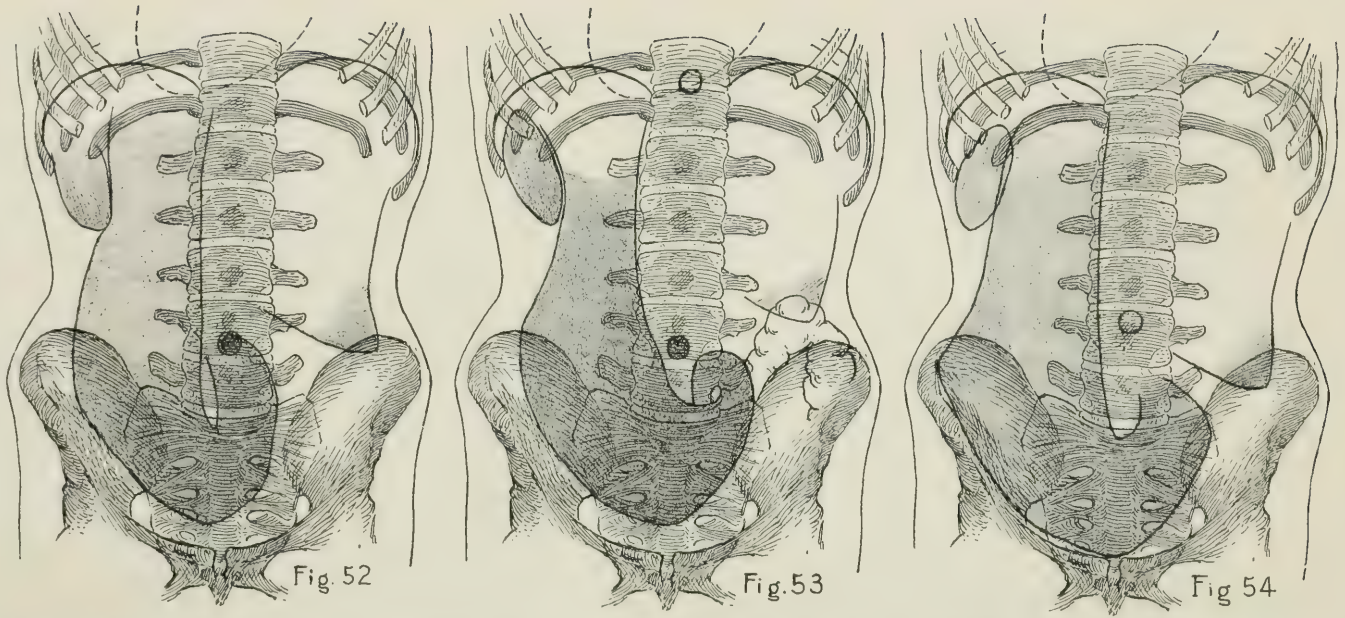
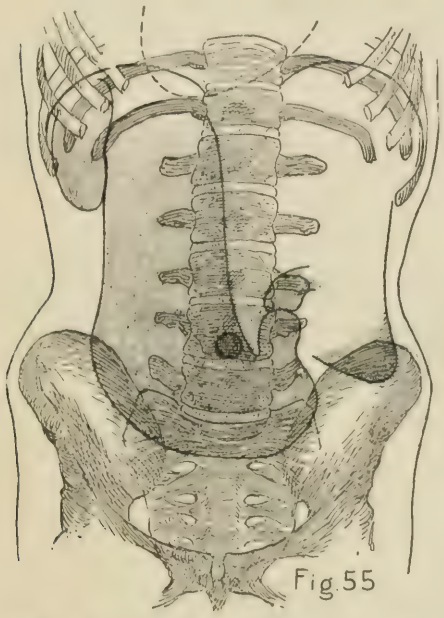
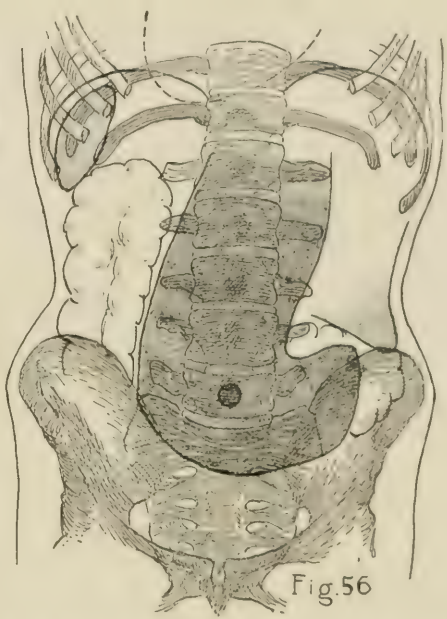


Fig. 52.—Dilated type, with extreme ptosis resembling the tubular variety more than any other. The extreme dilatation is the predominant feature. The pylorus is very low anatomically and moderately high relatively, and displaced to the left, with a decided kink. The pyloric end does not share in the dilatation. The gastro-hepatic ligament and low pylorus are the predominant factors in the ptosis which is further increased by the dilatation. The liver and spleen are moderately ptosed.

Fig. 53.—Dilated type, with extreme ptosis of the sagging variety, which is in itself a result of the dilatation. The pylorus is very low both relatively and anatomically, but is not displaced to the left. There is no evidene of a pyloric kink. The liver and spleen are moderately ptosed. The gastro-hepatic ligament and the low pylorus are primarily the essential factors in the ptosis, which is very much exaggerated by the dilatation. A very small part of the colon is outlined by gas, but probably the transverse colon and hepatic flexure at least are considerably ptosed.

Fig. 54.—A typical case of extreme dilatation, with extreme ptosis resembling none of the other types in any particular points. Ptosis may have preceded the extreme dilatation, and probably did, but the latter is now the predominant feature. The same factors,—the gastro-hepatic ligament and the low pylorus—are evident here as in the preceding cases, but the extreme degree of ptosis is the result of dilatation. Marked retention is always a feature of such a stomach. The patient was extremely emaciated as an evidence of malnutrition. The liver and spleen are ptosed.





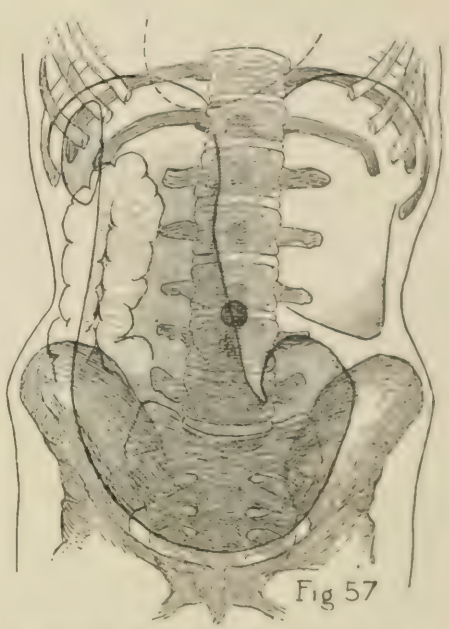


Fig. 55.—Dilated type, with moderate ptosis which seems to be due largely to the dilatation. The pylorus is slightly ptosed anatomically and relatively high, and not displaced to the left, as would be expected in simple dilatation. There is a marked kink, but it is not sharp. The gastro-hepatic ligament is of course partly responsible for the ptosis and the ptosed liver may be a factor as well, or simply associated with the gastroptosis. The spleen is moderately ptosed.

Fig. 56.—Dilated type, with extreme dilatation and moderate ptosis. The peculiar feature of this case is the unusual displacement of the entire stomach to the right side. This may be partly or wholly accounted for by the enormous gaseous distention of the left half of the colon, pushing the stomach over or turning it on the axis of the lesser curvature. The ligament must be very lax to allow this amount of displacement. The pylorus is low both anatomically and relatively. The liver and spleen are moderately ptosed, and also the hepatic flexure and transverse colon.

Fig. 57. Dilated type with enormous dilatation and extreme ptosis. Such extreme dilatation could not exist without such a degree of ptosis. Of course the underlying factors in the ptosis are the gastro-hepatic ligament and the low pylorus, but they are overshadowed by the dilatation. A further study of dilated normal and anatomical types is necessary in order to determine whether such dilatation as this is ever primary, or whether ptosis is always primarily the cause of the dilatation. The liver is moderately ptosed but the spleen lies in about its normal position. Only the left half of the colon can be determined by the gas, but the transverse loop seems to be ptosed, and in fact, it would be practically impossible for it to maintain its normal position in the presence of such extreme gastroptosis.

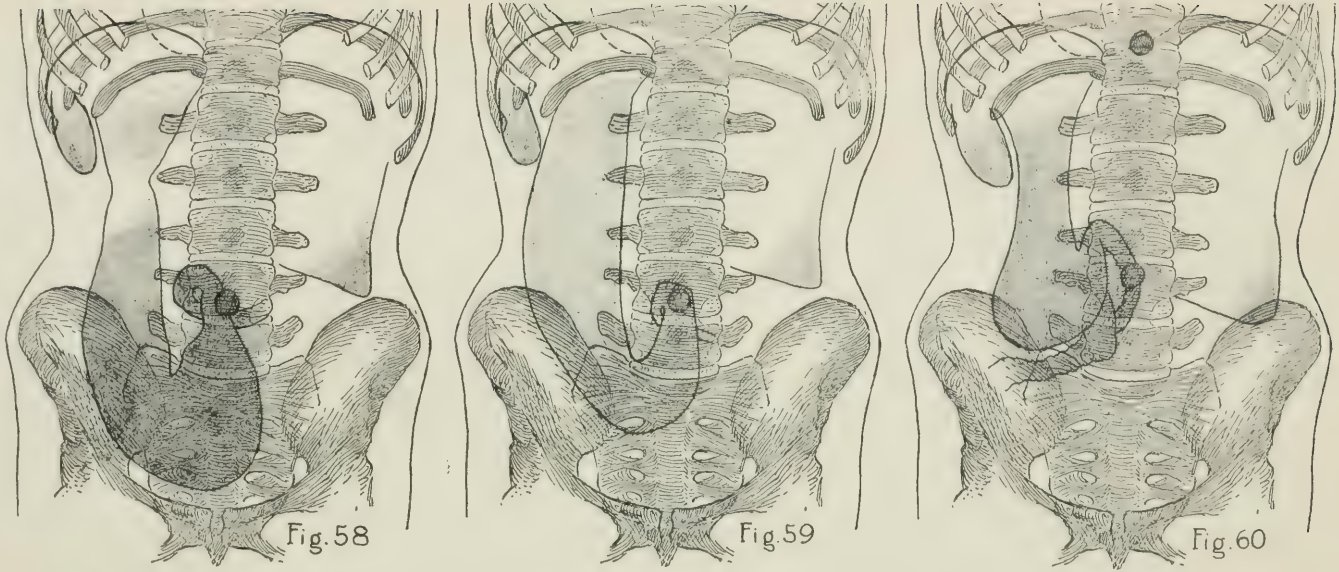


Fig. 58.—An extreme degree of gastroptosis resembling the sagging type, with considerable dilatation. There was clinical evidence of an "hour glass" contraction below the cardiac end, and this is confirmed by the skiagraph. It was probably spasmodic, as its presence was not confirmed at the time of operation. The pylorus is very low anatomically, but relatively high, and displaced to the left, with a decided kink. The ligament and displacement of the pylorus are the predominant factors. The symptoms pointing to ptosis and retention were marked. The liver is moderately ptosed.

Fig. 59.—The same case several months after gastro-enterostomy. From a clinical standpoint the operation was a success, as the symptoms were greatly relieved and the general health very much improved. The following results may be noted from the skiagraphic standpoint: 1. The previously retentive portion of the stomach now drains, and dilatation from retention and mechanical obstruction is lessened. The pyloric kink is not noticeable now. 2. The "hour glass" contraction has disappeared. 3. The degree of ptosis is decidedly less, and it now resembles the tubular type. This is a point in favor of the sagging type being an advanced stage of the tubular due to dilatation from mechanical retention of some kind. 4. Although a small amount of bismuth has passed through the pylorus, the main exit is the artificial opening. There is no skiagraphic evidence of a tendency toward a vicious circle, nor was there any clinical evidence of the existence of such a result. As to the skiagraphic evidence of the relative merits of this operation, the favorable results have been enumerated. Decided factors in gastroptosis, however, still exist, the relaxed ligament and low pylorus,- and are likely to remain. Time alone can determine the permanency of the clinical improvement.

Fig. 60.—A case of gastroptosis after gastro-enterostomy. The skiagraph made before the operation was a failure, therefore the exact condition at that time is not known. However, the degree of ptosis is certainly decidedly less, and this is because retention has been relieved. The stomach is still vertical, but a shortening of the ligament could not have restored this to the normal position altogether because of the ptosis of the liver. But the pylorus might have been raised and brought over more to the right. Any kink that may have been present has been obliterated. The present appearance favors the possibility of hypermotility. Although most of the bismuth seems to escape from the new opening, there is still most too much escape through the pylorus, and there is some evidence of a tendency toward a vicious circle, though there were no clinical manifestations of such a result.

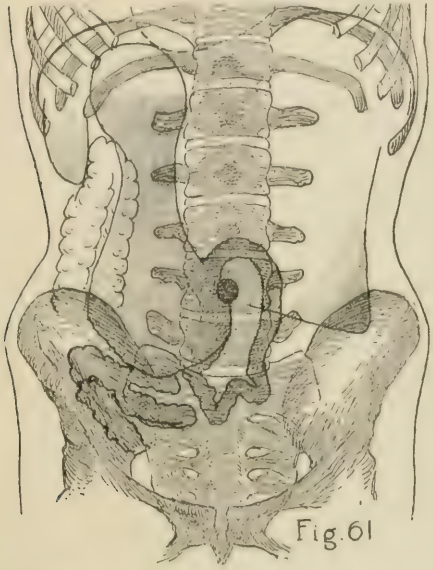


Fig.61

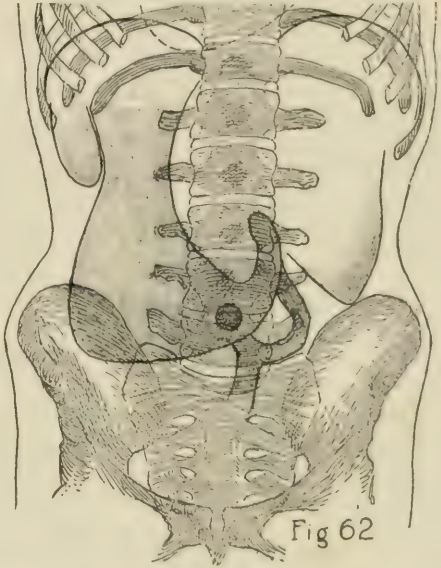


Fig 62

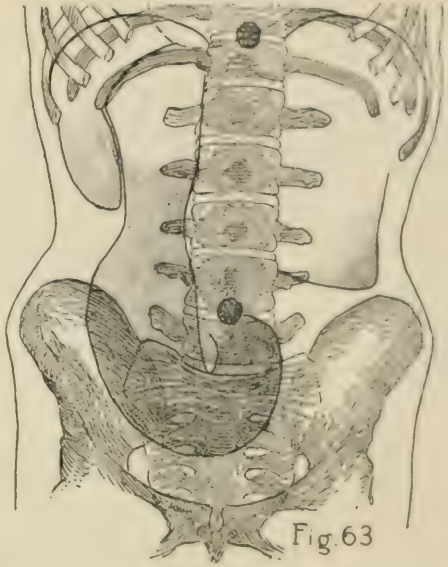
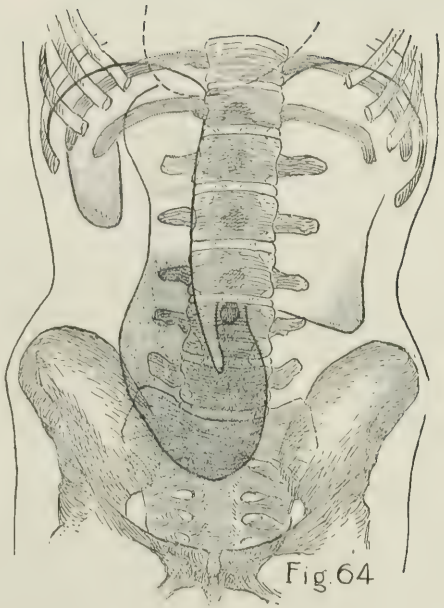


Fig.63

Fig. 61.—A case of gastroptosis with dilatation, after gastro-enterostomy. No skiagraph was made before the operation. The stomach appears small considering the contents introduced as a large quantity of the bismuth mixture has escaped into the small bowel during a very short interval before the skiagraph was made. This indicates abnormal hypermotility, though this is hardly an appropriate word to use in this instance. Most of the bismuth in the small bowel has escaped through the artificial opening, but all that has escaped has probably not passed onward, for it is unusual, in our experience, for the duodenum in a short time to contain sufficient bismuth to make itself shown so prominently in the skiagraph. Its presence there may be accounted for in two ways. Some has escaped through the pylorus and has not been carried along, and it is quite likely that there has also been some carried there by a backward flow from the artificial opening. We have, therefore, evidence of a possibility of a vicious circle, though there were no clinical manifestations of such a condition. Like the preceding case, the stomach is still vertical, though dilatation is lessened, giving the muscular coat an opportunity to regain its tonicity. If a pyloric kink existed, it has been obliterated. Shortening of the ligament could do little more toward correcting the position of the stomach, although correction of the position of the pylorus might. The sagging tendency still persists. The transverse colon is evidently ptosed.

Fig. 62. This diagram represents a skiagraph of a case made 3 weeks after a gastro-enterostomy for chronic ulcer. There must also have been a considerable degree of gastroptosis, judging from the present position of the greater curvature, the vertical position of the stomach, the moderately low position of the pylorus, and the associated moderate ptosis of the liver and spleen. There was probably some dilatation also. The gastro-hepatic ligament is still relaxed, evidently. Although the clinical data indicated ulcer, there must have been some symptoms due to ptosis. Dilatation from obstruction may have been primary in this case. There is evidence of the possibility of a vicious circle, although clinical manifestations of such a condition was wanting. This evidence is the presence of bismuth throughout the duodenum, with the pyloric end of the stomach nearly empty.

Fig. 63.—A case of gastroptosis with dilatation, after gastro-enterostomy. No skiagraph was made before operation, but there must have been an extreme dilatation and ptosis of the sagging type, because both are still marked, while the symptoms have been greatly relieved. The favorable results have been relief of retention by drainage, and decrease in the dilatation and ptosis, although muscular tonicity is not yet restored. Evidence of factors in ptosis, the gastro-hepatic ligament and the displacement of the pylorus, still exist, and judging from appearances, these could be corrected, to some extent



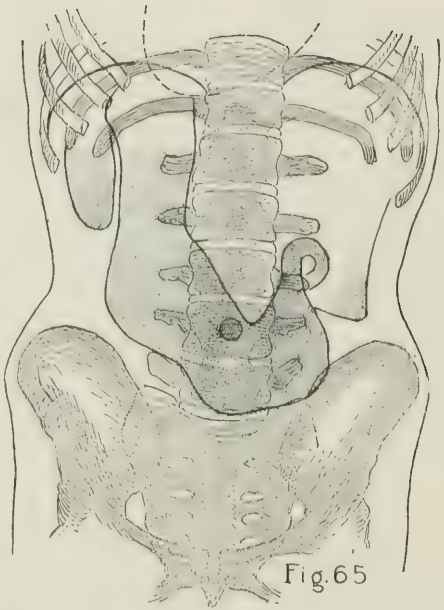
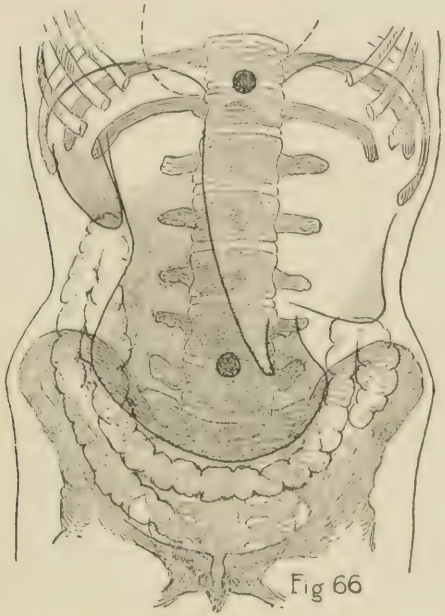


Fig. 64. Moderate degree of ptosis of the sagging type, before operation. The full extent of dilatation possible is probably not indicated, because of the small amount of contents in the stomach at the time of the examination, but the essential factors in the ptosis and the important features of the case are shown. The pylorus is moderately low anatomically, but relatively high, and displaced to the left, with a marked kink. The gastro-hepatic ligament is evidently relaxed. The liver and spleen are moderately ptosed. Symptoms were sufficiently marked to indicate operation.

Fig. 65.—The same case, about one year after the Beyea operation. From the skiagraphic standpoint, the results of shortening the gastro-hepatic ligament have been as follows:—1. There has been a return to the normal shape of the stomach, although some simple dilatation still persists. 2. The pylorus has been raised considerably, and carried well over to the right side. 3. *The kink has been entirely obliterated.* 4. The vertical position has been changed to one as nearly horizontal as would be possible by any procedure. 5. Retention has been relieved to a great extent. 6. Some relative anatomical ptosis still persists (but it has been reduced to a minimum), because of the persistence of dilatation and some moderate ptosis of the liver. Clinically, the operation was a success, and skiagraphically the result has been as nearly perfect as possible, by any procedure.



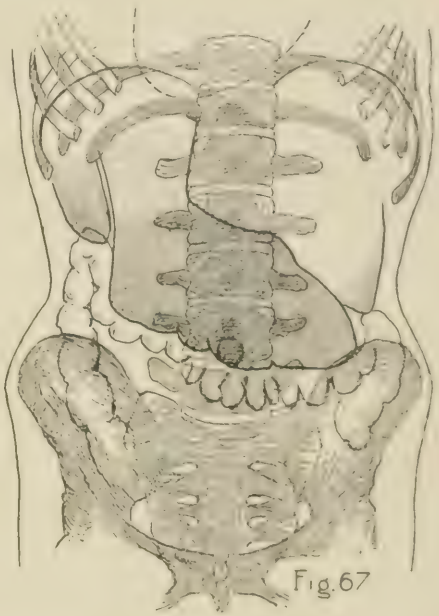


Fig. 66.—A case of moderate gastroptosis of the anatomical type, with a tendency to sag, and with considerable dilatation, associated with ptosis of the entire colon, but especially of the transverse loop. The pylorus is low anatomically, but relatively, moderately high. It is not displaced laterally. Although there is some kinking, the gastro-hepatic ligament is not much relaxed. In addition to the ligament and displacement of the pylorus as primary factors, the ptosis of the transverse colon and the dilatation are secondary factors, reflexly. The liver and spleen are moderately ptosed.

Fig. 67.—The same case after the Coffey operation. Both stomach and colon have been elevated to as near a normal position as could be possible, considering the position of the liver and the degree of dilatation. The colon ceases to be a factor in the ptosis. The pylorus still remains low anatomically and therefore persists as a factor, but not as an active one, as its relative position is normal. The relaxation of the ligament cannot have been corrected, though it may recover later. Mechanical retention has been overcome, and for this the operation deserves special credit. The operation has, in fact, overcome all mechanical difficulties, apparently, and the clinical results have been all that could be desired.

TUBERCULOUS MENINGITIS, WITH SPECIAL REFERENCE TO THE SPINAL FLUID

BY G. CANBY ROBINSON
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THERE have come recently to the Ayer Clinical Laboratory cerebro-spinal fluids from nineteen cases of tuberculous meningitis. The examinations of these fluids have been of distinct aid in the diagnosis of the disease. All of the patients except one were in the wards of the Pennsylvania Hospital and a brief summary of the clinical findings in these eighteen cases reveals the following facts.

Age.—Young adult life was the usual time when these patients were affected, the average age being 26 years. The youngest case was 5 years old, and the series includes five children. The oldest patient was 51.

Tuberculosis elsewhere than in the central nervous system was usually present. Physical signs pointing definitely towards tuberculous lesions were found in 11 cases, and questionable signs were twice present, while only 5 cases seem to be free from discoverable lesions outside of the central nervous system. In 7 cases there was pulmonary tuberculosis, in one case tuberculosis of the hip, in one pleural effusion, in one an indefinite peritonitis, and one case was said to follow a somewhat indefinite attack of what was at first considered typhoid fever. Of the four cases that came to autopsy, all showed generalized tuberculosis.

Nervous symptoms were quite variable. In half the cases headache, rigidity of the neck, Kernig's sign, diminished or lost knee jerks, "tache cerebrale," unconsciousness, coma and delirium, were present without other nervous symptoms.

A partial or complete hemiplegia was present in 5 cases. One case developed a left-sided hemiplegia, complete except for the upper third of the face. It appeared on the tenth day of the illness and largely cleared up in three days. The second case showed a partial

paralysis of the right side with diminished sensation. This partially disappeared in twenty-four hours. In the third case a varying left sided paralysis, most marked in the face and partial in the extremities, was noticed. The fourth case showed a marked weakness of the right side while in the fifth there was partial paralysis of the right side with decreased reflexes. Convulsions occurred in three children but were not seen in adults. Babinsky reflex was noted four times, and the knee jerks were found exaggerated four times, twice with and twice without paralysis. Catalepsy was seen in one case at onset, and persistent hiccoughing occurred once.

The eye condition was noted in 15 cases. In four no changes were seen. Unequal pupils and strabismus were the commonest findings. The former was present in 9 and the latter in 7 cases. Nystagmus was noted 3 times and loss of reaction to light twice. Exophthalmos was present once in both eyes, and once in but one eye. Ptosis was present in one patient, choked disc was once noted, and cloudy disc once.

Duration of the illness after the onset of meningeal symptoms was from 7 to 30 days, the average being 17 days. All the cases grew rapidly and progressively worse, terminated fatally, and no remissions were seen.

The fever was not high as a rule except in the terminal rise, which occurred in 7 cases. The temperature averaged from 100° to 102° and in 9 cases it was quite irregular.

Blood.—The leucocytes were counted 19 times in these cases. The lowest count was 6,500, while the highest, in a child, was 27,450. The average count was 15,192 and a moderate leucocytosis was usually present. The Widal reaction was done in 8 cases and a positive reaction was obtained in three, while once it was slightly suggestive. In order to show how closely tuberculous meningitis may simulate typhoid fever with meningeal symptoms, the following case is mentioned in some detail.

B. J., 42, colored, admitted October 10, 1904 (No. 2248). On account of the condition of the patient but a brief history was obtained, and nothing was known of his family or past history. He had been ill 21 days, the first week being characterized by malaise. He then had headache, pain in his neck, photophobia,

slight cough, loss of appetite, and pain in abdomen. On admission the patient was irrational and unconscious. Pupils equal and contracted. Râles and impaired resonance noted at base of right lung. Abdomen distended and tympanitic. Neck rigid, Kernig's sign present, no paralysis. The patient was in a "typhoid state" and presented the general appearance of having typhoid fever. On the twenty-fourth day of his illness, three days after admission, a positive Widal was obtained, and the leucocyte count was 7,000. Two days later the Widal reaction was positive in high dilutions, while the leucocyte count was 18,000. The fever was quite steady, and remained between 101° and 102°. On the twenty-fifth day of the illness lumbar puncture was done, but no fluid obtained, and on the following day, the twenty-sixth, the man died.

Lumbar puncture performed postmortem failed to reveal tubercle bacilli. This was the only spinal fluid in which no coagulum formed. An autopsy was performed and showed general acute disseminated tuberculosis, chronic apical tuberculosis of left lung, tuberculous meningitis, generalized tuberculosis, fatty degeneration and cloudy swelling of liver and kidneys.

Lumbar puncture in this series was usually performed but once in each case, and then for diagnostic purposes. "Dry taps" were done in 3 cases before a successful puncture was performed. No harmful effects were ever seen, although in but one case was there any improvement noted following the procedure. In one case when the fluid seemed under much pressure, lumbar puncture was performed 8 times in 9 days and 380 c.c. of fluid were obtained in all.

The spinal fluid from 19 cases of tuberculous meningitis have been studied for diagnostic purposes, and the results confirm the belief that lumbar puncture is of much diagnostic value in this disease.

Although Lichtheim first demonstrated tubercle bacilli in the spinal fluid, it was Fübringer who first showed that the organism could be found in a large proportion of cases. He found the tubercle bacilli 30 times in 37 cases or in 81 per cent. Since then the findings in a number of series have been published.

Bernheim and Moser found tubercle bacilli in 44 of the 60 cases they examined, or in 73 per cent. Slawyk and Manicatide found them in 84.7 per cent. or 16 times in 19 cases. In the

three negative cases, positive results followed injections of the fluid into guinea pigs. Lauger found tubercle bacilli 18 times in 22 cases, or in 81.8 per cent., and more recently Bernstein reports an excellent series of 40 cases in 38 of which he demonstrated tubercle bacilli; that is, in 95 per cent. A number of smaller series of cases have been published and Kaufe after an extensive study of the literature, says that tubercle bacilli are found in the spinal fluid from cases of tuberculous meningitis in from 25 per cent. to 100 per cent. The finding of the organism is largely a question of technic and perseverance.

In the 19 spinal fluids which form the subject of this paper, tubercle bacilli were found 17 times, or in 89.5 per cent. In one of the negative cases the diagnosis was made at autopsy, while in the other the diagnosis was made from clinical evidence. The usual method of searching for the organism was to allow the fluid to stand for several hours, as a rule from 12 to 24, until a filmy coagulum appeared. This coagulum almost invariably formed, and it was removed by a needle, spread by tearing upon a slide, fixed by heat and stained for tubercle bacilli with carbol-fuchsin and Gabbitt's methylene blue. In 2 cases the coagulum was removed in 2 hours. It was not found necessary to put the fluid on ice, as has been recommended. The coagulum was fairly readily spread out, and as a rule the tubercle bacilli were easily found. A moderate number or a few were usually present, but in two cases there were large numbers. This procedure seems to be a more successful method than centrifuging the fluid. It was used by Slawyk and Manicatide, Lauger, and others. Bernstein first spreads out the coagulum and pours the last few drops of the centrifuged fluid over it. Perhaps this combination of methods accounts for his good results. Lenhartz describes putting a small piece of sterile fleece into the fluid which catches the tubercle bacilli, but as he had but one positive case in 7 this method does not seem to be of much avail.

In our series of cases we encountered no mixed infections. Cultures were made upon blood agar, hydrocele agar, blood serum, and plain agar. All were negative except in one case, where a large coarse coccus, apparently a contamination, was obtained.

The general characteristics of these fluids were for the most part such that a probable diagnosis could be made from the macro-

scopic appearance. The fluid in 12 of the 19 cases was almost perfectly clear, with a slight opalescence, and in it a fine cobweb-like coagulum soon formed as a veil-like mass hanging down from the surface and spreading out towards the bottom of the tube. The fluid was slightly turbid in four cases. It was white and cloudy in one case, once it was blood stained, and in but one case did the coagulum fail to form.

Comparing these fluids with a series of 20 spinal fluids from cases of epidemic cerebro-spinal meningitis upon which I have reported elsewhere, it is seen that the characteristics of the two groups are quite different. The spinal fluid from the latter group was always purulent early in the disease, and but once, on the forty-seventh day of the disease, was a clear watery fluid in which a coagulum formed obtained. In a number of spinal fluids obtained postmortem from patients without meningeal disease, clear watery fluid in which a coagulum never formed was obtained.

The amount of fluid obtained from tuberculous and from epidemic cerebro-spinal meningitis cases was in the two series practically the same. In the tuberculous cases the amount was from 3 to 60 c.c. with an average of 19.3 c.c., while in the epidemic form the amount averaged in 20 cases 19.5 c.c.

It is fair to say that when clear, slightly opalescent fluid in which a veil-like clot forms in a few hours, is obtained comparatively early in the disease in a case with meningeal symptoms, that in all probability the patient is suffering with tuberculous meningitis. The finding of tubercle bacilli is the sure and final test.

This series of cases of tuberculous meningitis is added to those already found in the literature to emphasize the value of examination of the spinal fluid in tuberculous meningitis and to show with what comparative ease the tubercle bacilli can be found.

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ANÆMIA INFANTUM PSEUDOLEUKEMICA, SPLENIC ANÆMIA, POLYCYTHEMIA WITH SPLENOMEGALY AND CHRONIC CYANOSIS, LEUKANÆMIA, APLASTIC ANÆMIA*

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ANÆMIA INFANTUM PSEUDOLEUKEMICA (V. JAKSCH'S ANÆMIA)

Anæmia infantum pseudoleukemica was originally described by von Jaksch (*Prager medicinische Wochenschrift,* August 6, 1890). Von Jaksch's patient was a child, aged 19 months, who presented an enlarged spleen, catarrh of both lungs, a marked anæmia, some œdema of the skin, slight swelling of the ends of the tibiæ and of the shafts of the ribs, and swelling of almost all the glands in the body. There was no enlargement of the liver, nor were there evidences of rachitic changes in the skull. The examination of the blood showed that this tissue was strikingly pale; erythrocytes, 1,380,000; leucocytes, 114,150; ratio 1–30. The highest count of erythrocytes while the child was under observation was 6,043,750; the lowest, 1,280,000. The leucocytes varied from 114,150 to 16,000. The hemoglobin was greatly reduced, at one time the record was 2.1 gm. hemoglobin to 100 gm. blood.

The disease is of slow onset and of chronic course; there are the usual signs of anæmia, and, in addition, one or more of the following symptoms: gastro-intestinal disturbance, apathy, œdema, prominent abdomen, and albuminuria. The blood shows a marked oligocythemia, marked oligochromemia, and a considerable leucocytosis. In one case there were 820,000 erythrocytes and 54,666 leucocytes. Nucleated red corpuscles, both normoblasts and megaloblasts, are found, and the blood shows a high degree of poikilocy-

* A lecture on the less common forms of Anæmia, delivered at the Philadelphia Polyclinic and College for Graduates in Medicine.

tosis. The nuclei of many of the nucleated red cells show karyokinesis. Eosinophilia is sometimes marked.

As an illustration of the difficulties of diagnosis between leukemia, pseudoleukemia, and anæmia infantum pseudoleukemica (von Jaksch) I will briefly mention three cases which have come to my personal notice.

In 1895 I made an examination of the blood of a boy, aged five and one-half years, for Dr. John B. Turner. The child had been sick for two years with periodic attacks of such a nature as to lead the attending physician to make a diagnosis of malaria. The child's mother noticed that his abdomen was beginning to swell and his development seemed to be arrested. There was no complaint of headache, vertigo, cough, expectoration, dyspnœa, palpitation, nausea, vomiting, diarrhœa, jaundice or hæmorrhoids. The child presented enlarged faucial tonsils and an enlarged pharyngeal tonsil. He had had periodic attacks of suppurative otitis media. His liver was enlarged; his spleen was distinctly enlarged and palpable. His inguinal, saphenous, and cervical lymphnodes were slightly enlarged and were a little harder than normal. There was a loud hæmic murmur heard all over the precordium and in the blood vessels of the neck.

I made a blood count just before etherization for the removal of the adenoids which gave the following results: erythrocytes, 5,087,500; leucocytes, 50,000; hemoglobin, 43 per cent.

The child recovered from this operation and late in 1895 he had an attack of scarlet fever with corneal ulcer, otitis media, and membranous rhinitis as complications. He recovered, however, and in April, 1896, a blood examination showed erythrocytes, 4,125,000; leucocytes, 28,900; hemoglobin, 45 per cent. A differential count gave the following result: Polymorphonuclear neutrophiles, 50.4 per cent.; lymphocytes, 14.6 per cent.; large mononuclears, 10.8 per cent.; transitionals, 8.4 per cent.; eosinophiles, 1.8 per cent.; myelocytes, 13.8 per cent.; eosinophilous myelocytes, 0.2 per cent.

The right tonsil weighed 42 grains; the left tonsil weighed 69 grains. The eyegrounds at no time showed leukemic patches.

The child died in the spring of 1898; but no autopsy was obtained.

In this case I think pseudoleukemia may be excluded on account of the slight enlargement of the lymphnodes, and the high leucocyte count; while the superficial nodes were all enlarged there were no large masses as are seen in that disease. The diagnosis lies between myeloid leukemia and anæmia infantum pseudoleukemica. I incline to the former because of the presence of myelocytes with the splenic enlargement. Of course, the diagnosis of malaria was not justified; the attacks of fever and sweating being fairly frequent accompaniments of leukemia.

On April 23, 1906, through the courtesy of Dr. F. B. Jacobs, I examined the blood of an Italian child, aged 5 months, who was a patient of his in the Dispensary of the Howard Hospital.

The child had greatly enlarged lymphnodes in the cervical region, both of the anterior and of the posterior groups, moderate enlargement of the axillary nodes on both sides and of the right inguinal nodes; the left inguinal nodes were not affected. The child's mother said that he was very restless at night and that he did not sleep, apparently on account of the pain produced by the enlarged nodes. The liver extended 1 inch below the costal margin, and the spleen could be felt ½ inch below the costal margin.

The blood examination showed: erythrocytes, 4,060,000; leucocytes, 39,520; ratio, 1–102; hemoglobin, 67 per cent.; color index, 0.82. The differential count gave polymorphonuclear neutrophiles, 56.6 per cent.; lymphocytes, 30.4 per cent.; transitionals, 9.4 per cent.; eosinophiles, 0.8 per cent.; myelocytes, 2.8 per cent. There was moderate anisocytosis and poikilocytosis. In counting 500 leucocytes two normoblasts were seen.

This case is probably an example of pseudoleukemia. The large size of the lymphnodes, the absence of a marked lymphocytosis (the lymphocytes are normally high in the blood of children), or of myelocytes, and the absence of marked poikilocytosis and of many nucleated red cells in the circulating blood point to this diagnosis.

On May 4, 1906, a Jewish child, aged 10 months, was admitted to Dr. Hamill's service in the Polyclinic Hospital (12,701). The child had been ill for five months complaining of cough, nightsweats, vomiting, and distended abdomen. The child's bowels were moving frequently; the stools being greenish and offensive. His temperature varied from 100.4° to 98°; his pulse from 138 to 84; and his

respirations from 44 to 24. His axillary, anterior and posterior cervical, and inguinal lymphnodes were enlarged slightly, varying in size from that of a small pea to a large one. There were no pathological signs in the lungs or heart, except for relatively rapid action of the latter. The spleen extended from the seventh rib to one inch below the anterior superior spine of the ilium and to within one inch of the median line: the notch was opposite the umbilicus. The liver extended three fingers' breadth below the costal margin. The child's appearance was distinctly anæmic.

I made seven blood counts in this case with the following results.

	May 4.	May 7.	May 10.	May 16.	May 21.	May 29.	June 6.
Erythrocytes	4,095,000	3,600,000	3,440,000	4,040,000	3,640,000	3,510,000	3,870,000
Leucocytes	17,120	14,240	16,160	12,880	6,320	10,400	8,480
Ratio	1—239	1—266	1—212	1—313	1—575	1—337	1—455
Haemoglobin	43%	42%	40%	45%	52%	50%	49%
Color index	0.52	0.58	0.58	0.55	0.71	0.71	0.63
Polymorphonuclear neutrophiles	14.6	40.2	24.0	36.2	40.0	26.6	23.8
Lymphocytes	64.8	34.4	46.2	49.2	44.0	51.4	63.4
Transitionals	12.0	20.4	23.0	8.6	9.8	15.8	6.0
Eosinophiles	4.4	1.8	1.0	3.0	1.0	2.4	2.8
Basophiles	0.6	2.2	1.6	0.8	2.6	1.4	0.6
Myelocytes	3.6	0.8	4.2	2.2	2.6	2.4	3.4
Eosinophilous myelocytes	0.0	0.2	0.0	0.0	0.0	0.0	0.0
In counting 500 leucocytes there were:							
Normoblasts	36	17	16	7	10	10	4
Megaloblasts	6	2	4	0	2	1	0
Poikilocytes	many	many	many	present	moderate	present	present

This appears to be a typical case of anæmia infantum pseudoleukemica. On the first examination there was a moderate oligocythemia, a marked oligochromemia, and a moderate leucocytosis. Nucleated erythrocytes were present as were poikilocytes. The eosinophiles were not excessive; but suggested that the stools be searched for parasites: parasites were not found, nor were ova present. The absence of masses of enlarged lymphnodes would exclude the splenic form of pseudoleukemia. The low leucocyte count even in the presence of the increase of lymphocytes would tend to throw doubt on the true leukemic nature (of the lymphatic form) of the process and the low percentage of myelocytes would tend to exclude myeloid leukemia.

The patient was discharged from the hospital improved on August 5, 1906, during my absence from the city, and no further blood examinations were made than those above recorded.

There is a difference of opinion among writers as to the nature of anæmia infantum pseudoleukemica; some believe it to be a primary anæmia (v. Jaksch), others think it is a secondary anæmia dependent on numerous conditions such as rachitis, marasmus, and other forms of malnutrition (Raudnitz, von Limbeck, Ebstein and Fischl). The fact that the measures which give relief in the secondary anæmias are of benefit in this condition, and the fact that the mortality is low point to the secondary character of the disease.

The treatment of anæmia infantum pseudoleukemica should be conducted on the lines laid down for the treatment of the secondary anæmias. A cause for a severe secondary anæmia should be diligently sought, and, if possible, removed. Rachitis, syphilis, and malnutrition should be treated according to the well-known methods which are of use in those conditions. The child should be placed in a room in which there is a maximum of sunshine, or better, if the climatic conditions permit, he should be kept out of doors. He should have the very best milk, produced under the strictest hygienic precautions.

Medicinal treatment should have for its object: first, the stimulation of the formation of erythrocytes; and second, the increase of hemoglobin. For both of these conditions iron is the best drug. Every practitioner of experience has his own favorite iron preparations which he understands how to use and in the results of which he has confidence. I use the pyrophosphate if iron extensively, writing the following prescription for a child two years old:

R
Ferri pyrophosphatis ..... ℥ii
Aquæ ..... ℥i
Syrupus simplicis q. s. ..... ℥iii
M.

This may be given in teaspoonful doses three times a day, four times a day, or every two or three hours, depending upon the severity of the anæmia. Strychnine sulphate may be added to this formula. Blaud's pill (Massa ferri carbonatis) is another useful form of iron in this form of anæmia. It may be given in doses of one-half to three grains, depending upon the age of the child.

In addition to iron, patients in whom a diagnosis of anæmia infantum pseudoleukemica has been made should receive arsenic for

its stimulating influence on hematopoiesis. No substitute for Fowler's solution (Liquor potassii arsenitis) has yet been found.

Cod liver oil and olive oil are of value as nutrients.

SPLENIC ANÆMIA.

Splenic anæmia is a chronic disease characterized by a primary enlargement of the spleen, and a marked anæmia. There is no enlargement of the lymphnodes and no demonstrable cirrhosis of the liver.

The patient presents the usual symptoms of anæmia; pallor of the skin and of the mucous membranes, dyspnœa on exertion and palpitation of the heart. The anæmia varies from a slight pallor to a grade so intense as to suggest pernicious anæmia. On examination the spleen is found to be enlarged and in some cases it reaches as low down as the umbilicus. The splenic enlargement precedes the development of the anæmia and is usually painless, although in some cases there have been recurring attacks of pain in the left hypochondriac region. Hæmorrhages are common; large hæmorrhages from the stomach have been noted by Osler (*American Journal of the Medical Sciences,* January, 1900), and hematuria, purpura, and epistaxis have also been recorded. Ascites is sometimes present; it may be due to the enlargement of the spleen or to the anæmia. The lymphnodes are never enlarged. Melanoderma is quite common.

An examination of the blood in a case of splenic anæmia will show a relatively high erythrocyte count, a relatively low hemoglobin percentage, and a low leucocyte count. In Osler's fourteen cases the highest erythrocyte count was 4,788,000; the lowest, 1,540,000; average, 3,336,357. The highest hemoglobin percentage in eleven of these cases was 60, the lowest 23. In thirteen of the cases the highest leucocyte count was 12,497, the lowest 2,500. In nine of the cases the leucocytes were below 5,000. The erythrocytes are often deformed, and normoblasts and megaloblasts may be found. The differential count of the leucocytes shows nothing of special interest, except that in some cases the lymphocytes are increased.

Histologically, in splenic anæmia the pulp of the spleen is found to be atrophied so that the increase in the size of the organ is due

to a proliferation of the fibrous tissue and an increase in the number of the endothelial cells of the lymphatic and the blood spaces.

In a case reported by Dock and Warthin (*American Journal of the Medical Sciences,* January, 1904), and considered to be an example of the early stage of splenic anæmia, the liver showed atrophy of the lobules, with atrophic and necrotic cells, and an endothelial or fibroblastic proliferation in the capillaries with some increase of the interlobular connective tissue, which appeared to be the forerunners of cirrhosis. The spleen in this case, which was removed at operation, showed thickening of the capsule and of the fibrous trabeculæ of the organ. The lymphoid tissue of the pulp was scanty and was replaced by a dense fibrous network which originated from the reticulum of the pulp, and, to some extent, from the endothelial cells of the blood spaces.

In another case reported by the same authors as a late stage of Banti's disease, there was, clinically, enlarged liver, enlarged spleen, moderate anæmia, hæmatemesis, and ascites, but no leucocytosis. The liver in this case was the seat of a periportal cirrhosis. The appearance of the spleen was much like that described in the first case. The splenic condition was considered to be older than the hepatic lesion. In both cases there was stenosis and calcification of the portal vein.

The disease is to be diagnosticated from pernicious anæmia, myeloid leukemia, pseudoleukemia with enlarged spleen, and cirrhosis of the liver with enlarged spleen.

In pernicious anæmia the spleen is usually not enlarged and the color index is high. In splenic anæmia the spleen is enlarged and the color index is low.

In myeloid leukemia the leucocyte count is usually high, although in quiescent periods the leucocytes may be normal in number or nearly so, and myelocytes are present in considerable numbers.

In pseudoleukemia the lymphnodes are greatly enlarged, forming symmetrical, hard masses, but the spleen, as a rule, is not much larger than normal. In splenic anæmia the superficial lymphnodes are not at all enlarged.

The diagnosis of splenic anæmia has been made in many cases in which an enlarged spleen was associated with a well marked anæmia. In some of the reported cases sufficient care has not been

exercised in excluding complicating conditions. The most common error is probably to make a diagnosis of splenic anæmia in cases of cirrhosis of the liver, in which splenic enlargement has occurred. The symptoms in a well-developed case are quite similar, but in considering the history of the development of the case certain factors may be discovered which will assist in making the differentiation. In splenic anæmia the enlargement of the spleen is primary and the anæmia develops secondarily. In a case of cirrhosis of the liver the liver symptoms appear before the spleen begins to enlarge. In a typical case of splenic anæmia there is a moderate reduction of the erythrocytes, a considerable reduction of hemoglobin, and a leucopenia.

A further complication in the diagnosis of these two conditions is produced by the description of a disease by Banti in which, in addition to the splenomegaly, and the anæmia, we find enlargement of the liver. In a case of Banti's disease, which is considered by some writers to be a late form of splenic anæmia, the changes in the liver follow the development of the enlarged spleen and the anæmia. In hypertrophic cirrhosis of the liver, on the other hand, the enlargement of the spleen follows the enlargement of the liver.

During the past winter there was a case of atrophic cirrhosis of the liver in the Polyclinic Hospital, in the service of Dr. Riesman. The patient was a Russian Jew, aged thirty-four years. There was a history of free indulgence in whiskey up to within about a year of the time he was first seen. He complained of gastric disturbance of eighteen months duration. His abdomen had commenced to enlarge one year before he came under observation and had gradually increased in size. Jaundice appeared eight months before he was admitted to the wards. Ascites was present when he was admitted. He had not expectorated blood, he had not vomited, but dyspnœa and pain in the back were present. On examination his heart was found dislocated upward and there was a systolic murmur, either hæmic in nature or due to the dislocation. His spleen was enlarged, his liver extended from the fifth rib to the costal margin. During his stay in the hospital the patient was tapped four times. He had nose bleed and on the day of his death he vomited blood three times, about four pints in all. There was no autopsy.

I made three blood counts in this case, one on February 22d,

one on February 26th, and one on March 5th. The patient died on March 6th.

	Feb. 22.	Feb. 26.	March 5.
Erythrocytes	4,830,000	4,780,000	5,040,000
Leucocytes	17,120	16,960	26,800
Ratio	1—282	1—281	1—188
Hemoglobin	60%	85%	84%
Color index	0.62	0.88	0.83
Differential count:			
Polymorphonuclear neutrophiles	75.6%	79.0%	94.2%
Lymphocytes	13.4%	11.0%	3.8%
Transitionals	6 4%	4.8%	0.6%
Eosinophiles	0.6%	2.0%	0.4%
Basophiles	1.2%	1.2%	0.6%
Myelocytes	2.8%	2.0%	0.4%

This is not the blood picture of splenic anæmia. The hemoglobin percentage is high, there is a leucocytosis which progressively increased and reached 26,000 before death; the differential count shows an increase of the polymorphonuclear neutrophiles, and a diminution of the lymphocytes.

The treatment of a case of splenic anæmia should be conducted on the lines laid down for the treatment of secondary anæmia. Removal of the spleen has not been followed by satisfactory developments.

POLYCYTHEMIA WITH SPLENOMEGALY AND CYANOSIS.*

The first case of polycythemia with splenomegaly and chronic cyanosis was reported by Vaquez, in 1892 (Comptes Rendus de la Société de Biologie).

This is a disease of insidious onset, which is met with usually between the ages of 25 and 53 years, and which pursues a chronic course of from eight months to ten years. The prominent symptoms of the disease are cyanosis with pigmentation of the skin, enlargement of the spleen, dyspnœic attacks, and exophthalmus. The patients also complain of digestive disturbances, such as distension of the epigastrium, nausea and vomiting, and occasional attacks of moderate diarrhœa. Persistent headache, vague pains, slight albuminuria, vertigo, clubbing of the fingers, and hæmorrhages have

* Since writing this lecture the excellent paper by J. M. Anders has appeared in the *American Journal of the Medical Sciences* for June, 1907. Dr. Anders reports two new cases, bringing the total number reported up to fifty-three.

been noted. The spleen often fills the entire left half of the abdomen, the lower border being on a level with the anterior superior spine of the ilium, and the mesial border reaching to the median line. The liver is also slightly enlarged. In a case reported by Weber and Watson (International Clinics, Vol. iv, 1905) the patient presented a form of confusional insanity. The cyanosis is at times so marked as to cause remark by the casual observer. For example, in a case reported by Aldrich and Crummer (*Journal of the American Medical Association,* April 6, 1907) the exposed skin and the conjunctivæ of the patient had a dusky red color, and on close examination a network of enlarged veins could be plainly seen: the school children called this patient "the red Indian." She complained of feelings of fullness in the head, dizziness, fatigue, weight and dragging in the abdomen, and pressure over the bladder.

The blood in these cases shows a great increase in the number of the erythrocytes, usually about 8,000,000, although they numbered 11,450,000 in a case reported by Blumenthal (*Bulletin de l'Académie Royale de Médecine de Belgique,* T. xix, No. 11, 1905), a marked increase in the percentage of hemoglobin, 120 per cent. in a case reported by Cabot (*Boston Medical and Surgical Journal,* 1899, No. 29), 130 per cent. in one reported by Hutchinson and Miller (*Lancet,* March 17, 1906), and 185 per cent. in a case reported by Weber (*Lancet,* May 13, 1905). The leucocytes are sometimes within normal limits and sometimes are much increased; but the ratio, even in the latter cases, shows a relative leucopenia. In Hutchinson and Miller's case the highest leucocyte count was 22,000.

The differential count shows a normal proportion of the different varieties of normal leucocytes; but in the case reported by Blumenthal there was 45 per cent. of myelocytes. In the case reported by Hutchinson and Miller two differential counts gave the following results: (1) Polymorphonuclear neutrophiles, 82.8 per cent.; lymphocytes, 5.6 per cent.; intermediates, 2.4 per cent.; large hyalines, 4.0 per cent.; eosinophiles, 2.8 per cent.; mast cells, 2.4 per cent. No abnormal leucocytes, no nucleated reds, no abnormal reds. (2) Polymorphonuclear neutrophiles, 83.2 per cent.; lymphocytes, 4.4 per cent.; intermediates, 3.2 per cent.; large hyalines, 3.2 per cent.; eosinophiles, 3.6 per cent.; mast cells, 2.4 per cent.

Nothing abnormal about the red cells. In the case reported by Weber (*Lancet,* May 13, 1905) nucleated red cells were found in the peripheral blood.

Autopsies have been made in ten cases.* In two there was primary tuberculosis of the spleen. In one hæmorrhage from the middle meningeal artery. In one hypertrophy of the heart, hypertrophy of the spleen, congestion of the brain, small, dark and soft suprarenal glands, and absent thymus. In one chronic parenchymatous nephritis, hypertrophy of the left ventricle, chronic splenic tumor with numerous anæmic infarcts, œdema of the brain, congestion and cyanosis of the serous membranes. In one cirrhosis of the liver, chronic splenic tumor, hæmorrhage into the gastric and the intestinal mucous membranes. In one an enlarged spleen. In one congestion of the brain and of the meninges, emphysema of the lungs with hæmorrhages, hypertrophy of the left ventricle, splenic tumor, enlargement of the liver, gastric ulcer. In the ninth case, the one reported by Hutchinson and Miller, the spleen contained areas that looked like anæmic infarcts; there was perihepatitis and perisplenitis; the yellow marrow of the femur was reddish in color and the marrow of the ribs was deep red and fluid. Microscopically the Malpighian bodies in the spleen were atrophic, the venous sinuses were congested and there were a very few erythroblastic foci in the pulp. The infarct-like areas resembled tubercles, but no tubercle bacilli were found in them. The examination of a single section of the bone marrow would not justify one in concluding that red blood cell formation was actively proceeding; but when the increase in the extent of the red marrow is taken into account the inference is that there was a general increase of the erythroblastic functions of the marrow. The liver was congested and showed slight fatty infiltration. In the tenth case, the one reported by Weber and Watson, the venules throughout the entire body were congested, the meninges were congested; there was emphysema and left ventricular hypertrophy; the spleen was enlarged and weighed 655 grams, the liver was enlarged and congested, and there was a gastric ulcer. The marrow in the humerus, the femur, and the tibia was red instead of yellow. The enlargement of the spleen was due to an increase of the splenic pulp and engorgement with blood.

* (For references to eight of these see paper by Blumenthal.)

In the treatment of this affection quinine has been used without success. Rosengart succeeded in producing temporary amelioration by bleeding; but in a short time the polycythemia returned. Arsenic and iron have been used without benefit. Blumenthal employed extract of spleen with some temporary improvement in the blood picture and the symptoms. The nitrites have been used.

Weber and Watson believe that the symptoms in this disease are dependent upon increased osmotic tension and increased viscosity of the blood. Therefore they believe that venesection will not do good unless it is associated with the introduction of normal saline solution. Any food or drug which is known to excite the erythrocyte-forming functions of the bone marrow, such as iron, or which is known to cause cyanosis, such as the coal tar products, should be avoided.

The X-rays were used by Weber (*Lancet,* May 13, 1905) in a case in which there was polycythemia with splenomegaly, but without cyanosis. The treatment was followed by an increase of the headache; but there was a diminution in the size of the spleen and in the number of leucocytes per cubic millimeter of blood.

LEUKANÆMIA.

In 1900 Leube proposed the term leukanæmia for a form of anæmia which could not be satisfactorily classified either as pernicious anæmia or as leukemia; but which presented characteristics of both. For example, a case is described by Mattirolo (*Folio Hæmatologica,* No. 6, 1905) in which the erythrocytes numbered 900,000, the leucocytes numbered 76,000, and the hemoglobin percentage was 20. Anisocytosis and poikilocytosis were marked; there were numerous normoblasts and very numerous megaloblasts; there were 51 per cent. of lymphocytes, and myelocytes and transitional forms were abundant.

In the *Journal of the American Medical Association* for February 16, 1907, Teeter reports a case which he calls leukanæmia.

The patient was a child, aged 6 years. She was taken ill rather suddenly with malaise, nausea, headache, and fever (101° F.). These symptoms were followed by vomiting which was incessant for about 36 hours, and the temperature rose to 103°. Two days after the beginning of the attack the vomiting ceased and the child

passed about one pint of bloody urine. Then the child was seen to be very pale and presented a slight degree of jaundice. The temperature rose to 104.5° and the pulse was 160 per minute. There was a to and fro pericardial friction, a venous hum in the vessels of the neck, slight enlargement of the liver, and enlargement of the spleen.

The blood count made three days after the beginning of the attack and the day after the development of the anæmia and the icterus was as follows: Erythrocytes, 1,530,000; leucocytes, 132,800; hemoglobin, 20 per cent. The differential count showed polymorphonuclear neutrophiles, 58.75 per cent.; lymphocytes, 19.5 per cent.; large mononuclears and transitionals, 4.25 per cent.; basophiles, 0.5 per cent.; myelocytes, 10.75 per cent.; Turck's cells, 0.25 per cent.; unclassified cells, 6.00 per cent. There were 20,000 nucleated red cells per cubic millimeter; 10 per cent. megaloblasts, 68 per cent. normoblasts, 19 per cent. metrocytes, 1 per cent microblasts.

The patient gradually recovered. In eleven days the blood count gave 2,335,000 erythrocytes, 14,400 leucocytes, and 40 per cent. hemoglobin. The author attributes the blood changes to a toxæmia of unknown origin.

APLASTIC ANÆMIA.

There is in old people a primary chronic anæmia of moderate grade with enlargement of the spleen, moderate poikilocytosis and excessive leucopenia, without either nucleated red cells or myelocytes in the circulating blood. There is a relative increase of lymphocytes, 90 per cent. in some cases, the polymorphonuclear neutrophiles are much diminished and the eosinophiles are absent. Sometimes there is high fever and at other times moderate fever of a continued or intermittent character. The cases end fatally. The signs of a hæmorrhagic diathesis make their first appearance late and then only in slight degree. The bone-marrow shows an entire atrophy or the signs of an acute destruction. Such a condition is known as aplastic anæmia. Kurpjuweit (*Deutsches archiv für klinische Medicin,* April 6, 1905, Vol. 82, Nos. 5 and 6) reported two cases in 1905; one was that of a man, aged 68 years, in whom the blood examination showed erythrocytes, 2,300,000; leucocytes,

normal; hemoglobin, 55 per cent.; no poikilocytosis and no nucleated red cells. Near the end of life there were 1,125,000 erythrocytes and 25 per cent. hemoglobin; slight poikilocytosis and one normoblast was found. The second case was that of a man, aged 62 years in whom the blood examination showed erythrocytes, 2,000,000; leucocytes, 1,000; hemoglobin, 30 per cent. The differential count gave polymorphonuclear neutrophiles, 23 per cent.; large lymphocytes, 42 per cent.; small lymphocytes, 26 per cent.; and mononuclears, 9 per cent. Slight poikilocytosis was noted, but there were no myelocytes nor no nucleated red cells. The day before death the erythrocytes numbered 1,925,000, the leucocytes, 600, and there was 25 per cent. of hemoglobin. The differential count showed polymorphonuclear neutrophiles, 67 per cent.; large lymphocytes, 11 per cent.; small lymphocytes, 17 per cent.; mononuclears, 2 per cent. On account of the increased percentage of lymphocytes Wolff (*Berliner klinische Wochenschrift,* January 9, 1905) is of the opinion that these are cases of lymphatic leukemia with aplasia.

The bone marrow in some of the cases shows complete aplasia, while in other cases it shows a lymphatic hyperplasia. In some cases aplasia has been found in some of the bones and lymphatic hyperplasia in others.

THE OPHTHALMO-REACTION TO TUBERCULIN, A NEW MEANS OF DIAGNOSING TUBERCULOSIS IN MAN

BY PROFESSOR G. CALMETTE
of Lille

I.

Von Pirket pointed out not long ago that when a small quantity of tuberculin is inserted in a slight scarification of the skin of a tuberculous patient, as early as forty-eight hours later, the little wound is seen to be red and œdematous, while frequently a sort of papule appears on it resembling false vaccinia. This papule effaces itself by desiccation in a week, and the redness vanishes. With healthy persons the cutaneous reaction to tuberculin seems exceptional. Valleé, of Alfort, has reported that this method of diagnosing tuberculosis, to which he suggests that the name cuti-reaction be given, yields the same results in bovidæ; it can be applied even when the animals have been tested a few days previously by subcutaneous injections of tuberculin.

It occurred to me to see, as was done recently by Wolff, of Berlin, in bovidæ, whether healthy mucous membranes, and in particular the conjunctiva, which absorbs with so much facility certain microbic toxins whether animal or vegetable (such as the diphtheritic toxin, abrin or snake poisons), might not be capable of giving an analogous reaction on contact with tuberculin.

The first series of experiments was undertaken in the Lille hospitals on twenty-five patients, children and adults, of whom sixteen were tuberculous and nine affected with non-tuberculous disorders. From these tests the following general results have been deduced.

In order to avoid the irritating action of glycerine on the conjunctiva I made exclusive use of dry tuberculin precipitated by alcohol (95 per cent.), and dissolved in sterilized distilled water. This solution is at one per cent., and must always be freshly prepared; one drop is allowed to fall in one eye of each patient.

Five hours after such an instillation, sometimes even three hours after, all of the tuberculous patients show very manifest congestion of the palpebral conjunctiva, which becomes bright red, and is more or less intensely œdematous. The caruncula swells, reddens and is veiled with a thin fibrinous exudation. The vascular injection increases little by little, and is accompanied by the secretion of tears. At the end of six hours the production of fibrin becomes more abundant, and collects in filaments in the lower conjunctival cul-de-sac.

The maximum reaction is observed between the sixth and tenth hours. The patients complain of no pain, but only of a little inconvenience, while they speak of a sensation of slight smarting and some disorder of sight in connection with the abundance of the exudate. No chemosis is observed, and the course of the temperature in the rectum is not noticeably influenced. It is easy to estimate the intensity of the reaction by comparing the eye that has not been treated by tuberculin with the eye which has been treated.

With children in eighteen hours, and with adults in from twenty-four to thirty-six, the signs of congestion diminish and then disappear.

When the subject is either healthy or affected with a non-tuberculous disorder, the instillation of tuberculin remains entirely inoffensive. At the most some slight redness can be noted in from an hour and a half to three hours afterwards, which soon disappears and is accompanied neither by fibrinous secretion nor by tears. In one of our series of twenty-five patients, with whom the nature of the disorder (supposed simple bronchitis, with slight tracheo-bronchial adenopathy) had not been suspected, the reaction was positive, showing the real nature of the disease.

This test, to which I propose that the term ophthalmo-reaction to tuberculin be applied, seems to be extremely delicate. It is worthy of the careful attention of clinicians, as its application is simplicity itself; its results appear much more rapidly than those of the cuti-reactions, which only manifest themselves after forty-eight hours, and it causes neither pain nor lasting inconvenience. In addition, so far as can be inferred by the experiments above mentioned, this method seems to present none of the drawbacks and risks connected with the hypodermic use of tuberculin.

Practitioners, who find it so difficult to make an early diagnosis of tuberculous disorders or to be certain that old tuberculous lesions are healed, will find, I hope, in the use of the new method of exploration a simple, elegant and rapid means of coming to an opinion.

II.

(Later.)

Since my report on this subject a month ago my experience has become more complete and I am now in a position to give more accurately the conditions under which this ophthalmo-reaction should be used for the diagnosis of tuberculosis in man. I have used it now in 115 cases, and have data from a grand total of 321 cases, thanks to the kindness of different colleagues. Letulle has collected 125, on which he made a report to the medical society of the Paris hospitals; his conclusions substantiate mine in every respect.

This series of 321 cases concerns every kind of disease, medical, surgical, and dermatological; nervous disorders, chronic disturbances of nutrition, traumatisms, as well as tuberculous manifestations of every form; and of the cases followed by myself, as well as those reported to me by other physicians, every patient clinically tuberculous, child or adult, reacted manifestly. Some cases under treatment for non-tuberculous complaints also reacted positively. On closer examination almost all of these were found to have suspicious signs of lesions, either of the lymph-nodes or lungs.

It therefore seems that the ophthalmo-reaction method enables us to reach an early diagnosis in many cases; it always gives positive indications in evident cases of tuberculosis, whether such be of the bones, lymph-nodes, viscera, meninges or lungs.

It may, however, fail, as Letulle has shown, with patients who are moribund, and who are incapable of any kind of defensive reaction, just as a hypodermic injection of tuberculin fails to induce a rise of temperature in tuberculous animals that have reached the last degree of cachexia.

The general rule is for the reaction to begin at the third hour, to become more evident at the sixth, to last from sixteen to twenty-four hours, and then to decrease and disappear after thirty-six to forty-eight hours. But in certain cases it can be retarded, and

only begins to appear twelve to twenty-four hours after the instillation, while it ceases about the seventy-second hour, and in exceptional instances even later. These retarded reactions, which are rare, may be as intense as the early ones.

There appears to be no relation between the intensity of the reaction and the gravity of the lesions. Patients with nothing more than simple tuberculous lymph-nodes react often more energetically than pulmonary cases with cavities. In many instances I have seen violent reactions in patients with very limited lesions.

When the test is to be repeated with the same patient the tuberculin should be instilled in the other eye, or else a week should be allowed to elapse and then the same eye used as before. In no instance have I observed any lasting disturbance of vision, nor severe pain. The patients speak merely of temporary discomfort due to tears and to the fibrinous filaments that tend to collect over the caruncula or in the lower conjunctival cul-de-sac.

No one of my patients presented the slightest rise of temperature, and their general condition and appetite remained excellent. The tuberculous lesions were not rendered worse nor modified during or after the reaction, which is an entirely local one. The method can therefore be considered absolutely harmless; it presents neither serious drawback, nor risk.

In some healthy persons slight but temporary redness is observed after the instillation of tuberculin; but this redness, due to rubbing of the eye, never lasts more than five or six hours and affects only the conjunctiva: the caruncula is not injected and there is no fibrinous exudate. These pseudo-reactions can cause no mistake in diagnosis.

To avoid any superposed inflammation, blepharitis, conjunctivitis, etc., it is essential to use nothing but an aseptic solution of tuberculin precipitated by alcohol. One should never use ordinary glycerated tuberculin (Koch's old tuberculin), because glycerine is slightly caustic in itself, and because this glycerated tuberculin, if impure, contains irritating foreign substances, such as resins, waxes, etc.

The best method of procedure consists either in using an aqueous solution of precipitated tuberculin, sterilized by moist heat (without exceeding 105° C.), or in preparing the solution extempora-

neously by dissolving five milligrams of dry precipitated tuberculin in ten drops of warm boiled water. One drop of this solution instilled in the inner angle of the eye, care being taken to prevent any involuntary winking which would immediately eject the drop, is always sufficient to produce the reaction. The patient's lids should therefore be held slightly apart for a few moments, and he should afterwards be cautioned against rubbing his lids. If he is unable to refrain from so doing, the eye should be protected with an aseptic bandage and dressing. When the reaction has taken place and the diagnosis is settled, there is no objection, naturally, in order to avoid any accidental infection of the conjunctiva, to the use of soothing applications of warm boric solution.

It is a wise precaution not to try the test with patients whose eyes or lids are already the seat of some disorder, especially since it would then lose its diagnostic value, and at the same time tend to render worse a pre-existing microbian infection. But with healthy patients infection is never to be apprehended, since the solution of tuberculin used contains no germs.

In a word, the ophthalmo-reaction to tuberculin enables us to reach with almost absolute certainty a diagnosis in various forms of tuberculosis where clinical and bacteriological examination fails to give a definite result.

As a method of exploration it is inoffensive, simple, efficacious and elegant, and in many cases practitioners will derive the greatest assistance from its use. As against the cuti-reaction of von Pirket it presents the advantage of creating no lesion, even superficial, either of the skin or mucous membranes, and consequently of offering no means of access to the system of any germs that may be lying in wait on them. It is furthermore accompanied by no pain whatever, and it produces in less than twenty-four hours indications just as exact as the cuti-reaction will give in a week.

Still more strongly does it deserve to be substituted in the place of the method of subcutaneous injections of tuberculin, on account of its entire safety.

Surgery

A CASE OF SARCOMA OF A RETROPERITONEAL UNDESCENDED TESTIS STRANGULATED BY A TWIST

BY ROBERT G. LE CONTE, M.D.
of Philadelphia

The following case seems worthy of record on account of its extreme rarity, for I can find but two similar cases in the literature, and because it is another pathological condition found in the right iliac fossa which may be mistaken for acute appendicitis.

P. P.; Italian, aged 28; single; laborer; was admitted to the hospital April 5, 1907.

He had lived in this country for four years, and had been in good health until ten days before admission, when he complained of pain in the abdomen, anorexia, nausea, feverishness, and extreme nervousness. Three days before admission the pain became very severe confining him to bed.

The meagre history is owing to our limited knowledge of Italian and the patient's inability to speak English.

His temperature was $100^{2}/_{5}$; pulse, 96; respiration, 22. The face was flushed; tongue coated; heart and lungs negative.

The urine contained a trace of albumen.

Examination of the abdomen revealed general tenderness, especially in the right iliac fossa, where there was a sense of tumor. Rigidity was marked over the whole abdomen, but was boardlike in the lower right quadrant. The penis was normally developed but the scrotum and inguinal canal were without testicles.

A leucocyte count was not made as he was operated upon within an hour of his admission to the hospital.

Diagnosis.—Diffuse peritonitis of appendiceal origin.

Immediate operation was advised and accepted.

An incision was made through the lower portion of the right rectus, and on opening the peritoneum some bloody, cloudy fluid

exuded. An ovoid tumor, blue-black in color, the size of an orange, immediately presented. It resembled in appearance a small, strangulated ovarian cyst, with a thickened tube drawn over its surface. There was a moderately thick, ribbon-like pedicle, which was attached to the retroperitoneal structures perhaps two inches above the right inguinal ring, the attachment being two inches long and the tumor twisted on the pedicle with two half turns. Traction on the tumor produced a ridge in the retroperitoneal tissues which extended to the right internal inguinal ring and tended to draw the ring towards the pedicle. A fainter ridge was also produced leading to the left inguinal ring, crossing the spine just above the peritoneal reflection on the bladder. A search in the abdomen did not reveal the left testicle.

The tumor was brought out of the incision, the pedicle untwisted, transfixed, ligated, and the mass cut off. The incision was closed, a small cigarette drain being left in the lower angle.

The diagnosis was revised to ectopic testicle strangulated by a twist.

Convalescence was uneventful.

A brother stated that the patient had some of the characteristics of a eunuch.

The following pathological report was made by Dr. E. L. Crispin:

Gross Description.—The specimen consists of a dark red fluctuant tumor mass measuring 13 x 8 x 8 cm. and weighing 410 gm. It is somewhat kidney-shaped with a small nodule at the upper pole. On the concave side there is a tough mass, 3 x 5 x 2.5 cm., attached by a broad base. From the end of this there is a cord-like structure thicker than a pencil and 4 cm. long lying on and attached by one side to the larger mass. Above the smaller mass and lying partly over its upper surface is a tough, cord-like tissue extending from the upper end of the small mass to the lower end and measuring 9 cm. in length. The whole tumor mass is covered by a thin smooth membrane in which large veins may be seen. Posteriorly this membrane from the larger mass extends smoothly over the smaller masses. Anteriorly it follows the convolutions, outlining these smaller masses. The large mass is quite fluctuant; about the middle, anteriorly, there is an area about 4 cm. in diameter

in which the tissue is thicker and fairly firm to palpation. There is a fibrous tag attached to the surface over this area. The smaller mass is quite tough and fleshy. The entire mass resembles, somewhat, a pus tube and ovarian cyst. On section 150 c.c. of dark fluid blood escapes from the numerous cyst pockets. The entire tissue is glistening, black and extremely soft and friable.

There are large areas in which there are thin, whitish, wavy strands of diffluent, blood-stained, gelatinous substance. The cysts contain a smooth-walled, lining membrane. The wall of the larger mass is very irregular, being very thin in some of the cysts, though the tumor is solid through the tougher areas described. The smaller mass, on section, shows a black tissue extremely vascular, quite tough, not friable, and in which white strands of connective tissue can be seen, also many vessel lumina with clots. The superior cap-like fibrous mass is reddish for about 2 cm. from the surface. The central tissue is so deeply blood-stained that its structures cannot be made out. In the midst of this is a raised area of softer tissue resembling very much a cross section of a fallopian tube. A lumen cannot be found with a small probe. The fibrous ridge attached to the main mass beyond the smaller mass looks the same, except for the absence of the duct-like arrangement of the tissue. Above the smaller tumor mass on the superior fibrous layer is a small fibrous cord, 1 cm. in length which breaks loose from its attachment with slight traction.

Microscopically.—The tumor is composed of great masses of aberrant cells. This tissue is greatly engorged with blood and in many places degenerating. The tumor cells are large and round with dark staining nuclei and are of embryonic connective tissue type. In places there is so much engorgement and degeneration that only the large cell outlines in masses of blood can be made out. In the less engorged and degenerate portions where the cells are clearly defined the tissue is seen to be composed entirely of large round sarcoma cells. Sections of the cord-like process described in the gross as resembling cross section of fallopian tube show a fibroid tissue greatly distended and packed with red blood cells. The vessel walls are thickened and among the red blood cells in the lumina are many large, round sarcoma cells. Scattered all through the extravasated blood in the section are polymorphonuclear cells

and nuclear fragments. In the middle of the section are many small tubular-like areas surrounded by connective tissue and having a cellular lining in which the small dark staining nuclei only can be made out. These in their arrangement and appearance are similar to the tubules of the epididymis. Sections through the fibrous cord running from the smaller tumor mass along the side of the greater are likewise so distended with blood and so degenerate that the central portions show only clot. The periphery however is composed of fibrous tissue which is very vascular, the vessels showing a considerable degree of endarteritis. All the vessels are engorged with blood. Sections from the greater curvature of the tumor show a fibrous wall greatly infiltrated with round and polymorphonuclear cells. The vessels are engorged and there are hæmorrhages into the connective tissue. Below the fibrous wall there are large alveolar-like groups of large round sarcoma cells. There are also irregular areas of these sarcoma cells all through the fibrous frame-work of the tissue. There are proliferating fibroid cells all through the stroma. Some of these have extended into the vessels in attempts to organize. Everywhere there are infiltrating round cells. In many places these form a circular layer about the vessels. Much of this tissue is so degenerate that the cells are poorly stained. Other sections from the greater curvature of the tumor show semi-necrotic pink-staining masses of large round cells in which the nuclei have entirely disappeared. Everywhere through the sections are seen masses of blood and fibrin in the sarcomatous tissue. Section through the smaller mass shows about the same picture. In this there is a fibrous wall filled with hæmorrhages and greatly infiltrated with polymorphonuclear and round cells. Beneath this fibrous wall there are large groups of sarcoma cells. The meshes of the connective tissue about them are greatly distended with blood and fibrin in which there are young connective tissue cells. The nuclei of the aberrant cells here are very irregular in size and staining properties. There are no recognizable areas of gland tissue to be found in the sections.

Diagnosis.—Large round-celled sarcoma of engorged and degenerating tumor which is probably an undescended testicle.

I can find but two cases in the literature of sarcoma of an abdominal testicle strangulated by a twist. The first was reported

by Gerster.[1] This was in a man 21 years old, who was taken ill the day previous to his admission to the hospital with frequent vomiting, fever, pain in the right iliac fossa sudden in onset, with a tumor. The patient had a hypospadias of the third degree, and neither testicle had descended. At the operation the tumor removed proved to be the right testicle, which was the seat of a sarcomatous degeneration and had become twisted on its pedicle. The left testicle, which was still in the abdomen, appeared to be normal in size and shape, and bore some resemblance to an ovary.

The second case was from Hochenegg's clinic in Vienna.[2] The man was an instructor, aged 38, the father of six living children. He had been troubled for seven months with severe intermittent pain in the lower left abdomen, so severe that for four days before admission to the hospital he had been confined to bed. During the intermissions of pain the patient had noticed a tumor in the left iliac region, and seven weeks before admission he noticed an increase in the size of this tumor. The abdomen was opened and a mass weighing 1100 grams was removed. The pedicle was attached to the retroperitoneal tissues in the left iliac fossa, and had a half twist in it.

Microscopic examination proved the tumor to be a testicle which had undergone alveolar round-celled sarcomatous degeneration.

It is a pity that in the case I have just reported the tumor was so greatly disorganized by the infarction that recognition of any testicular tissue was impossible, so the diagnosis is only reasonably certain. As a careful search in the abdomen for the left testicle did not reveal this organ, the possibility is suggested of the two testicles having been fused, one of them having undergone sarcomatous degeneration while the other remained in an undeveloped or rudimentary condition. The absence of any other body like a testicle, together with the fact that the tumor evidently had attachments which led to both inguinal rings, might make this hypothesis tenable.

The subject of undescended testicle is too broad to be more than touched upon in this short communication, but it would seem expedient to discuss in connection with this case two conditions

[1] *Annals of Surgery*, vol. xxvii, p. 649, 1898.

[2] *Wien. klin. Woch.*, vol. xx, No. 11, March 14, 1907.

which were present, *viz.*, strangulation of the organ and malignant degeneration.

1. *Strangulation.*—Nearly all organs of abdominal origin are liable to rotation and twisting of the pedicle, but, as Scudder has pointed out,[3] strangulation of the testis cannot occur in the normal organ. He shows that one of the essentials to twisting is a long mesocorium. In the embryo, as the testicle lies at the back of the abdomen, the mesocorium is comparable to the mesentery, only it is much thicker and acts as a suspensory membrane for the epididymis. It contains the nutrient vessels of the testes and epididymis. If the testis develops normally this membrane disappears, and its place in adult life corresponds to the space that is not covered by the tunica vaginalis where the vessels enter the testicle and epididymis.

According to Bramann [4] the testicle has more or less incomplete fixation in all anomalies of its development and in all disturbances of its descent. In nearly all anomalies in the descent of the testicle the mesocorium is lengthened. This is explained in the following way: The processus vaginalis develops normally, and owing to the delay in the descent of the testicle the changes which would normally take place in it do not occur, and it remains a comparatively large cavity. When the testicle finally descends it hangs in this cavity and as it grows drags down the cord until by the time it reaches the bottom of the cavity there is a long mesocorium. Scudder states that in all recorded cases of torsion of the cord operated upon, a deformity or some delay in development or some abnormal condition about the testicle has been found. In 47 per cent. of all cases of torsion the testicle involved was undescended, lying within the inguinal canal or but partially descended lying close to the external abdominal ring. In every instance there was a long mesocorium. It would therefore seem that the overgrowth or lengthening of the mesocorium is the predisposing cause in strangulation of the testis. As the exciting cause the same factors which produce strangulation of an ovarian cyst or pedunculated fibroid would operate on the intra-abdominal testis with a long mesocorium, while in a partially descended testicle traumatism

[3] *Annals of Surgery*, Aug., 1901, p. 234.
[4] *Archiv. f. Chirurgie*, vol. xl, p. 137.

or unusual muscular contractions in the neighboring muscles could produce the twist.

2. *Malignant Disease.*—Practically all the writers upon this subject during the last century are of the opinion that an arrested testicle is a source of danger to its possessor on account of its liability to sarcomatous degeneration. This opinion is firmly fixed in the professional mind.

On the other hand Eccles [5] has made a study of a great number of cases and has concluded that there are not sufficient grounds for the belief that sarcoma is of more frequent occurrence in imperfectly descending testicles than in the normal organ. As we have no means of judging of the frequency of undescended testicles, because statistics on this point are not obtainable, we cannot get a just estimate on this subject. Testes which may be undescended at birth frequently come down to their normal position within the first year, and if not then they may do so before puberty. Therefore, statistics which would report the frequency of undescended testicle at birth or at the end of the first year would vary greatly and would not hold true for later periods in life. The statistics of Marshall, quoted in Kocher's Surgery, show that in an examinatoin of 10,800 recruits he found 12 cases of undescended testicle, 1 to 900, but as Odiorne and Simmons [6] have pointed out, such statistics are inaccurate, for many men recognizing the fact that they were imperfect in this respect would not apply for the army. To contrast the percentage of malignant changes in the undescended testis with the percentage of malignancy in the normal testicle is therefore impossible.

There are, however, certain microscopic differences that are almost invariably noted in the undescended testicle which would lead one to believe that the views of the older writers are correct in that such an organ is more liable to malignant change. Odiorne and Simmons have summed up these histological differences as follows:

The tunica albuginea is thick, sometimes as much as five times thicker than in the normal organ. The basement membrane of the tubules is also much thickened, and in many sections the lumen of

[5] *Lancet*, March 1 and 15, 1902, pp. 569 and 722.

[6] *Annals of Surgery*, Dec., 1904, p. 965.

the tubules is destroyed or represented only by a mass of dense fibrous hyaline tissue. The epithelial lining of the tubules also shows marked deviation from the normal, and the interstitial cells, one of the most striking features of the undescended testicle, are present in large numbers. These cells are normally seen in small numbers in the testes of children but disappear about puberty and are not found in the adult organ. In the undescended testicle the reverse is true and large numbers of the cells are always present. If, therefore, we have an organ which remains in part in a more or less embryonic state and which by its misplacement is rendered more vulnerable to traumatism, for the normally placed testicle is admirably adapted to escape injury, it is not difficult to believe that such an organ would be more liable to undergo malignant degeneration than the normal organ. In a series of 54 cases of malignant disease of the testicle at the Massachusetts General Hospital during a period of 26 years, 6 cases were in arrested testicle, *i.e.,* 11 per cent. Schädel stated that in one of the London hospitals there were 41 cases of malignant disease of the testis seen in one year, 5 of which were in undescended testicles, *i.e.,* 12 per cent.

Malignant disease of this organ is extremely rare in children and uncommon before the twentieth year of life. It is most often noted in the inguinal form but it is almost as frequently seen in testes which have been retained in the abdomen. It would therefore seem that trauma does not play a very important part in the production of malignant changes, for surely the intra-abdominal testes are as well protected as any organ can be. I would therefore judge that if the misplaced organs are more frequently the seat of malignant change, that this is due to the histological differences in the tissues from the normal, and perhaps, as has been suggested, to the very large number of interstitial cells present.

FRACTURES OF THE FEMUR

BY H. P. SIGHTS, M.D.
of Paducah, Kentucky

Since the treatment of fractures is essentially the most important feature connected with the country physician's surgical practice, the subject of this paper should be one of interest; in order to treat such cases intelligently one must have a thorough knowledge of the methods of management employed by the most skilful surgeons to enable him to secure the best results. Previous to the performance of many other surgical operations, careful preparation for the work and time for investigation is relied upon for good results, which is not true in the majority of fracture cases.

There are few physicians and surgeons who have not been called upon to treat fractures of the femur, and the majority without hesitation recommend, with the utmost confidence of ultimate success, the use of a plaster cast in such instances. However, Buck's extension apparatus is not infrequently used in fractures of the upper end of the bone, and Hodgens' splint is also employed in some instances where approximation is difficult.

After carefully examining a given fracture to determine as far as is possible the character and position of the fragments, the probable difficulty of approximation, the amount of injury inflicted upon the soft tissues, etc., the surgeon must decide what form of dressing is most appropriate, and which will be of the greatest aid in securing the best results. There can be no doubt that in oblique fractures extension and counter-extension should be employed.

To indicate the utmost importance of careful management and treatment of fractures of the femur, I may be permitted to mention two cases which have come under my observation in which there occurred no semblance of bony union, resulting in most serious disappointment to the attending surgeon, and a great misfortune to the patients. Both these patients were males, both addicted to the use of alcohol, and in consequence were extremely nervous and unfavor

able surgical subjects. The location of the fracture in each case was at the junction of the middle and upper thirds.

In this connection it is well to remember a resolution, which must have been intended as a danger-signal as well as a protection to the medical profession, suggested by Doctor James M. Keller at a meeting of the American Medical Association, as follows: *Resolved,* That in all fractures of the femur there will necessarily be more or less deformity!

In this short paper I cannot hope to suggest anything new in regard to the conditions which may predispose to bad results, the methods of investigation by which the character of the fracture may be more accurately determined, nor the most appropriate modern methods of management, for we have reports of fairly satisfactory results in all varieties of fracture of the femur, excepting perhaps the neck and upper end of the bone, treated according to the methods already in vogue. However, I do hope to be able to indicate a few reasons why the surgeon should treat each particular case as though it differed materially from others, usually regarded similar in character; in fact I am confident that very few of these cases are exactly alike, and he who loses sight of this would make as great a blunder as the tailor who would attempt to fit every customer by using the same pattern! Lane, in a very able article, affirms that it is more important to re-construct the damaged skeleton to its original form in fractures of the lower extremity than in the upper, for after a certain age fractures in the lower extremities are likely to produce permanent changes, causing the patient to experience a feeling of insecurity and discomfort, and especially so in fractures of the femur. Another reason which should prompt the surgeon to exert the utmost skill in attempting to secure good results in the treatment of these fractures, is to restore to the patient that form and manly bearing of which our race is so proud.

For more than half a century medical literature has been impregnated with the sentiment that fracture of the neck of the femur was an impossible accident! But admitting that it might occur, as in the larger percentage of such injuries the patient is aged, it was considered fatal; if the patient did not promptly succumb, certainly there occurred permanent loss of function of the limb! In support of this I could quote literature from the days

of Sir Astley Cooper down to the present time, from medical text books, medical journals, and also from the teaching of medical colleges! Cooper admitted that he had never seen a bony union occur in a case of intracapsular fracture of the neck of the femur. His treatment consisted in placing the limb on a long pillow for ten days or two weeks, afterward allowing the patient to be up and about on crutches.

About twenty years later Agnew adversely criticised the methods of Cooper, and advised treating fracture of the femoral neck on the same general principles as fractures elsewhere in the bone, viz.: by extension on a straight or incline plane, adding that he had seen numerous fractures believed to be intracapsular recover with bony union, which amply justified the procedure he recommended.

The elder Gross, commenting on the treatment advocated by Sir Astley Cooper, considered it entirely too pessimistic, and added that for many years he had been in the habit of treating fractures of the femoral neck as any other fracture of the femur, viz.: by extension and counter-extension, not with the hope of obtaining bony consolidation but with the view of keeping the ends of the fragments in more accurate contact and thus affording them an opportunity of becoming united by fibro-ligamentous tissue.

Ridlon, in an excellent article on treatment of fracture of the femoral neck, remarks: "Let me assure you, gentlemen, that in all these cases a strong and useful limb in good position may be as confidently anticipated as in any other fracture of this or any other bone! In no other fracture is the surgeon's task easier, in none is good result more certain! . . . I believe we can treat the patient properly by treating the fracture from which he is suffering and likely to die! . . . The average surgeon treats fractures of the neck of the femur precisely as he treats a solution of bony continuity, where he aims to get a false joint, and verily he usually has his reward. My plea is simply this: Show the fracture at the neck of the femur the same consideration that you show all other fractures. It is useless to quibble about fractures within the capsule, and fractures outside the capsule; fractures impacted and fractures unimpacted; about the thin weak bone of fat old women, etc.; these cases result in strong and useful union if given a fair chance."

Although the views of Doctor Ridlon appear equally as optimis-

tic as those of Sir Astley were pessimistic, he has undoubtedly given us good grounds for encouragement, and his plea should be an inspiration to surgeons.

In case of fracture of the neck of the thigh bone, occurring in elderly individuals, treat the patient and let the fracture be of almost secondary importance. The impacted cases will unite, the unimpacted may unite, and again in only two cases out of sixteen can it be said that the leg becomes functionally useful (Scudder).

Treatment must be so ordered as to save life, even at the expense of an imperfect leg. The American Text Book of Surgery recommends extension and fixation with sand bags and plaster of Paris, and in ununited fractures reports several cases as having been cut down upon, but does not give the result of the operation (Park). In certain cases, where the patient is over sixty years of age, give up the idea of securing bony union (Curtis).

Doctor Swayne considered the only rational treatment was to allow the patient to move about on a mattress of hair. He states the patients will get well if spared the necessity of useless apparatus, and will recover with as good a limb as they are likely to have if they could survive the torture of the apparatus. This treatment saves life and suffering, and all treatment should have these ends in view rather than glorification of the surgeon in displaying his skill in adjusting apparatus and setting limb. We feel sure that some of his patients would have recovered had they been let alone instead of receiving the orthodox treatment. He concludes by saying that the surgeon is not a mechanic, to adjust appliances, but one whose judgment and experience should determine their necessity!

As will be observed from the foregoing excerpts, there appears to be a great deal of uncertainty about the outcome which may be expected in fracture of the femur from any form of treatment that has been suggested, as the opinions of authors differ so widely in regard to the results secured by resort to the various apparatus, appliances, etc. Operative intervention in the hope of securing bony union has been advocated by Koenig, Cheyne, Meyer and others, but there yet exists considerable uncertainty in the minds of a great many modern surgeons as to the advisability of the operation. In support of this statement I desire to offer the following

from the work of Bryant: "There is yet a reasonable doubt regarding the advisability of this operation except in special cases. The difficulty of securing and maintaining proper adjustment of the fragments because of the lack of command of the inner portion, its porous character and low vitality, presents obstacles to success that cannot be gainsaid. The degree of shortening that follows the successful results suggests an initial failure of reduction of the deformity, or the maintenance in proper place, and bespeaks in any event a considerable amount of absorption at the site of the fracture. A more extended experience is needed and a careful comparison of the favorable results by different methods of treatment is required before a final judgment can be recorded."

In determining what procedure is most appropriate in treating these fractures, as is evident from the information gained by the experience of others, it is necessary to make a careful and painstaking investigation as to the character of the fracture, the temperament of the patient, cause of the accident, the general conditions surrounding the patient, etc., before one can decide intelligently as to the method or appliance to be used. It is considered unnecessary to discuss or describe at length the three popular dressings commonly used for fracture of the femur, *viz.*: plaster cast, Buck's extension, and Hodgens' splint. In all instances except transverse fractures in which there is no displacement of the fragments or so little hæmorrhage and swelling that the broken surfaces can be brought by traction or manipulation into accurate apposition, there should be applied some means of extension, noting the axis of the fragments. This is usually done by comparing the injured with the uninjured limb.

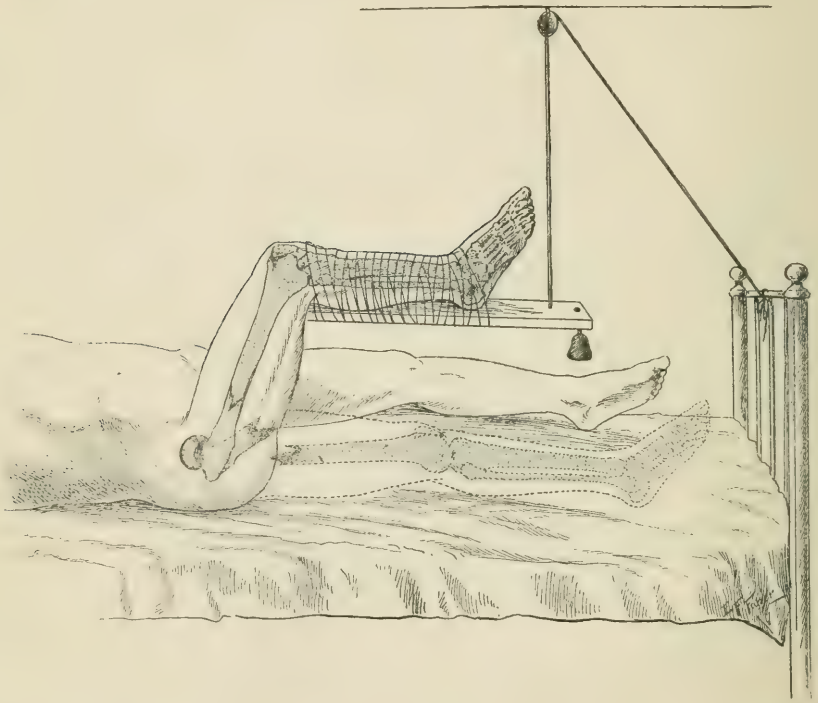
Based upon my own experience I can recommend as appropriate, in all cases of fracture of the femur below the upper third, either one of the three modes of dressing mentioned and with the promise of good results; but in fractures about the neck of the femur I desire to suggest the employment of an apparatus which has given entire satisfaction in the two cases I shall briefly report and in which it was used.

Case 1.—A male, aged sixty-four years, weighing one hundred and seventy pounds, fell on a polished floor and sustained a fracture of the neck of the femur. Treatment: flexed thigh, suspended the

leg and kept it in that position for three weeks, then put in plaster of Paris. The patient recovered promptly, with only one inch shortening, and with good use of the limb.

Case 2.—A male, aged seventy-eight years, fell on the ice sustaining a fracture just below the trochanter. The upper fragment was drawn upward and, with the patient in the recumbent position, was very prominent. The patient lived six miles out in the country,

Fig. I.



and was first seen by another physician of this city who put the limb on a double incline plane temporarily. Being unable to visit the patient the following day he requested me to take charge of the case, and gave an unfavorable prognosis owing to the advanced age and unfavorable surroundings of the patient. I immediately dressed the limb in a flexed position, and it was kept suspended from the ceiling for a period of three weeks when the apparatus was removed and a plaster of Paris dressing applied. This was allowed

to remain intact for three weeks, the patient being permitted to sit up one week after the plaster was applied. The outcome was more favorable than we anticipated, the patient is able to walk without the aid of a cane, and there is only about half an inch shortening, scarcely enough to affect his gait.

The method advocated simply carries out the principle of treatment in fractures of any other bone, viz.: apposition of the fragments, correct position and immobility of the muscles by relaxation. It also secures a position of the patient which permits moving the hips at will, thereby enabling him to keep the dressing clean and prevent bed sores; and in a restless patient allows change of position without disturbing the fracture. I would especially recommend this dressing in fractures in old people, and also in all forms of fracture at the upper end of the femur where the upper fragment of the bone is drawn upward by the psoas magnus and obturator muscles. (Fig. 1.)

The method of procedure is simple, the apparatus uncomplicated and easy of application: Envelop the fractured limb in cotton, including the hip, use an external splint extending from the trochanter to the knee. I prefer two or three narrow strips of heavy tin to any other form of splint. Next apply a flannel bandage from the foot upward ending in a spika around the hips. This is not difficult to accomplish provided a McBurney hip rest be used. Flex the thigh to right angle with the body, allowing the leg to rest on a splint about three feet long and seven inches wide padded on top with cotton at the end of which is suspended a five-pound weight. This splint is suspended from the ceiling by means of a pulley, the rope being attached to the splint on either side of the ankle allowing the weight to make extension on the muscles of the thigh. Usually two or three strips of bandage tied from the knee to the ankle will steady the limb sufficiently.

I cannot understand how any conscientious surgeon can leave his patient, it matters not how old and feeble, with a fracture of the femur unreduced and unimmobilized. The relief to be obtained by the procedure mentioned would justify its application, if no bony union were expected. I would be pleased if every surgeon, who has a case of such fracture, would give it this opportunity for relief and recovery, doing his best for good results.

SUMMARY

First.—The experience and teaching of the profession have been discouraging as to treatment of fractures about the head of the femur.

Second.—That the plaster of Paris dressing has been so commonly and satisfactorily used in fractures of the femur that we become discouraged if it fails in fracture of the neck of this bone.

Third.—With proper treatment we may expect bony union as well in fractures of the head of the femur as in the shaft.

Fourth.—That age is not a contraindication to the treatment.

Fifth.—That the best results are obtained from the treatment which furnishes perfect immobilization and approximation.

Sixth.—That the plaster of Paris cast and Buck's extension are not the most favorable methods of treatment in fractures of the aged or even the young.

Seventh.—That the use of suspension apparatus is more comfortable to the patient, convenient to the nurse, and more favorable as to ultimate outcome.

Eighth.—Old ununited fractures can only be relieved by operative treatment, and in this class of cases the fluoroscope gives valuable aid.

SURGICAL SYPHILIS

BY CHARLES GREENE CUMSTON
of Boston

SECOND PART.

Specific disease of the muscles occurs in the form of a diffuse or gummatous myositis. Generally speaking the diffuse form is an early manifestation of lues, while the gummatous type occurs late in the disease. Not rarely, however, both forms occur simultaneously, while the diffuse type may also arise in the later stages of syphilis and inversely, gummata may occur in the early stages (Neumann). Gummatous myositis may attack any muscle and it has even been met with in the diaphragm. Certain muscles are more prone to be attacked, principally those situated high up. The predilection of syphilis for certain muscular groups applies to both the diffuse and gummatous myositis. Most frequently the sterno-cleido-mastoid, biceps, flexors of the forearm and masseter are attacked. The size and number of syphilomata of the muscles vary, in some cases they arise symmetrically, as in the case reported by Eger, where there were two symmetrically located syphilomata in each sterno-cleido muscle developing at about the level of the larynx. This same authority mentions another case where symmetrical syphilomata occurred in both masseters. In a case recorded by Guttmann, beside the occurrence of syphilomata in the lymphatic glands, the same growth was found in the clavicular portion of both sterno-cleido muscles.

Syphilomata of the muscles have a great tendency to involve the neighboring structures, so that not infrequently the periosteum, cartilage or bone may be involved. Not infrequently the subcutaneous tissue is attacked, when the growth has extended through the fascia. The skin covering the growth will then be found no longer movable over the tumor and presents a bluish red hue and evidences of inflammation. Traumatism may give rise to an ulcerative process and infection from the entrance of bacteria.

Small syphilomata may be caused to undergo absorption by

antisyphilitic treatment, while the destroyed muscle substance becomes replaced by fibrous tissue. The larger syphilomata are very obstinate to treatment and, although the latter may be extensive, they may nevertheless soften and ulcerate. If, however, they are absorbed through medical treatment, the defect left behind them in the muscle will vary according to the size of the neoplasm though more or less shortening and diminution of functions will always result.

Generally speaking, the symptoms consist of dull pain at the seat of the growth and besides this the affected muscle becomes easily tired. Larger neoplasms may cause certain functional disturbances. If a syphiloma presses upon and irritates the neighboring nerves, the pain may be very severe, but otherwise there is not apt to be any tenderness.

When there are other syphilitic manifestations, as well as when other neoplasms are present elsewhere, the diagnosis becomes comparatively easy, especially when the patient is of an age at which malignant growths are infrequent. If there is only one tumor and if the history and examination show no other syphilitic process, it is then very hard or indeed impossible, to come to a correct diagnosis, especially if the tumor rapidly increases in size, as in the last case mentioned.

According to Kaposi, the diagnosis of syphiloma of a muscle is more easily made and with more certainty when the early stages of softening and degeneration are reached and he says: "In this case the oldest central portion and that part in relation to the skin sinks in, whereas the peripheral portion appears hard to the feel and rounded. In this stage the gumma becomes biscuit shaped. While this form is characteristic of syphilitic infiltration with degeneration in the central and oldest parts, and the developing manifestations in the peripheral portion, as well as the course of specific symptoms in this stage, gummata of the muscles can be almost positively diagnosticated. In other stages, their differentiation from other growths is very difficult." Now, as gummatous myositis is of relatively frequent occurrence, one should always take syphilis into consideration when dealing with a tumor of a muscle. A large number of cases have been published where a syphiloma of a muscle has been taken for a malignant tumor and

has been operated upon. Many writers have given a note of warning, and Esmarch has even gone so far as to say that in many cases antisyphilitic treatment should be advised and will give good results, assuming that in most cases, perhaps in all, of sarcoma of the muscle, a syphiloma exists. Consequently, the advice given by Nélaton should be followed, namely: "Every muscular tumor should be first treated by antisyphilitic measures;" however, it appears to be more advisable to make an exploratory incision, which should be followed by a microscopical examination in order to avoid error.

Syphilomata, which may cause such serious functional disturbances and symptoms, as pressure on the trachea, œsophagus, or recurrent nerve, should be operated on, because, generally speaking, muscular syphilomata, especially those of large size are most obstinate to antisyphilitic treatment, even when it is continued for a long time. As I have already pointed out, suppuration and ulceration may occur in spite of specific treatment, leaving behind deep funnel shaped and deep depressed scars, adhering closely to the underlying structures and this condition of affairs may be very largely avoided by operative interference.

The history of three cases of syphiloma of the muscle will now be recorded, none of which suggested specific infection, either in the history of the case, or in clinical examination; these occurred at the Surgical Clinic of the University of Kiel and were reported last year by Rosenberger.

The first case is of interest, because the syphiloma arose at a spot where three years previously a traumatism had been inflicted. A male, age not stated, married for four years and the father of four children, one of which died at the age of three weeks. The patient has always been well. Three years ago he was caught between the buffer of a train and fractured a rib. Two years after this he noticed a lump, the size of a pea, at the point where he was struck, which caused him to consult a physician, who informed him that the costal cartilage was thickened. In July, 1899, the tumor began to grow rapidly and upon the advice of his physician the patient entered the Surgical Clinic upon September 21st. He looked fairly well at this time. In the right axillary line over the fourth, fifth and sixth ribs was a tumor about the size of a fist.

The skin covering it appeared to be in a condition of chronic inflammation. The consistency of the growth was firm, but its base was not adherent to the underlying structures. On the next day under chloroform the tumor was cut down upon and proved to be seated in the pectoralis major; it was removed and on section was immediately recognized as being a syphiloma. The wound was closed. As the microscopic examination verified the diagnosis the patient was placed upon inunctions and after three treatments he was discharged, being advised to continue the ointment. The wound healed by first intention. Now, although there was some suspicion of the growth being a gumma of the muscle, on account of its very sudden growth, as well as its exposed position, operation was resorted to, because extirpation was deemed the simplest method of cure.

The second case was a female 36 years of age. In the Spring of 1902, she noticed a small swelling, the size of a pin's head, seated subcutaneously in the middle of the sternum. It increased in size and extended toward the ribs on each side. At the same time she experienced dragging pains in the breast, which increased at night when lying down, or upon movement. Fourteen days before entering the Clinic she consulted a physician, who prescribed some drops and referred her to the Clinic. The patient was a medium sized and well nourished woman. Integuments and mucous membranes pale, appetite good, bowels constipated. No cough nor expectoration. Examination of the lungs revealed nothing abnormal. Heart slightly displaced towards the right, sounds clear and action regular. The thorax gave evidence of a deformity, in that the second and third ribs on both sides, including their sternal portions, were arched forward. At these points the sternum was also slightly projecting. There was no tenderness on pressure, but percussion just below the lower projection caused pain. The abdomen was soft and flat. Above the symphysis there was a cicatrix of a paramedian incision which protruded somewhat on coughing. Above and to the right the epigastrium was somewhat tender on pressure.

On September 14th operation was undertaken under chloroform narcosis. A transverse incision was made over the cartilage of the fourth rib and sternum, exposing a neoplasm in the pectoralis

major. On section the tumor was grayish red in color, at spots somewhat yellow, its borders not sharply defined and continued irregularly with the muscles. At the insertion of the pectoralis it lay directly on the sternum, the latter, however, not being involved. After removal of the tumor the hæmorrhage was controlled and the wound closed with drainage.

As microscopical examination proved the tumor to be a syphiloma, inunction treatment was begun on the 21st of October, the patient being allowed to return to her home on the 19th of November. After completion of the treatment she was ordered to continue this at home. The wound healed, and the swelling on the sternum disappeared as well as the pains in the region of the liver.

The third case was a male 48 years of age, who entered the clinic on February 10, 1901, presenting a very marked tumor on the extensor surface of the right forearm, the growth being about as large as the palm of a hand. The skin covering the growth was bluish, but there was no evidence of inflammatory process and no tenderness on pressure. The tumor could not be distinctly separated from the bone. Since neither the patient's history nor examination gave any evidence of luetic infection, the diagnosis of a tumor of the fascia (sarcoma) was made and operation performed under chloroform narcosis.

The growth was composed of a number of smaller growths about the size of a hen's egg and extended diffusely into the fascia and muscular tissue. The neighboring tissues presented an inflammatory œdema. The multiple tumors were removed, together with the skin and the extensor muscle. Microscopical examination showed that it was a syphiloma and the patient was immediately placed on iodides, the wound healing well.

On account of the removal of all of the extensor muscles, a partial stiffness of the wrist and elbow joint resulted with a consequent interference with the patient's work. Whether or not the syphiloma would have disappeared under antisyphilitic treatment is doubtful given its large size, but in all probability the usefulness of the forearm would have been diminished even if there was not the operation, because, according to the patient's story, the tumor had developed very rapidly.

An interesting case occurring in Prof. Helferich's practice, that

of anal fistula of a syphilitic nature, has also been recorded by Rosenberger. The patient, a male, 44 years of age, was operated on in June, 1898, for a rectal fistula. No information could be obtained as to the result, but nothing of any importance could be obtained from the patient. On March 2, 1901, the patient presented himself with a suppurating fistula, accompanied by an extensive phlegmonous infiltration of the soft parts on the right extending to the posterior gluteal region. An operation performed under chloroform narcosis disclosed very extensive pus cavities and tracts, which extended to the right side of the anus, as well as outwardly into the right buttock and from the rectum into the pelvis. All these cavities and tracts were carefully broken down so as to form one large cavity which was plugged with gauze.

The progress of the case was favorable, there being no rise in temperature or other untoward symptoms. It was soon noticed, however, that the tendency towards granulation was not very active, healing being very slow. At last, on the edge of the anus, between the mucous membrane of the rectum, which had been pulled upwards, and the external integuments, a defect in the granulation was discovered. A complication set in unexpectedly and an abscess formed in the right buttock underneath the scar, which was then opened. This complication led one to suspect the syphilitic nature of the process and, therefore, inunctions were commenced and the iodides given internally.

There was an improvement in the condition, although, around the anus, a defect in the granulations still remained and was surrounded by thickened skin and mucous membrane. The patient was discharged, but returned occasionally for examination.

On February 3, 1902, another inflammatory process was found around the scars and therefore, the iodides were given, but without improvement. On a renewed and thorough examination on March 24th, a supppurating channel was found opening into the region of the granulating wound from the right buttock, through which varying amounts of pus were passed. For certain reasons the patient could not be operated on immediately, so that the interference was not undertaken until the 17th of April. An extensive incision was made in the right buttock and anus and all the suppurating canals and pus cavities were opened up. In the thigh

extensive undermining reaching far downward, was found, so that the operation finally led to a very extensive procedure. The wound was packed and healed without interruption, although it was surrounded by small and dirty ulcerating areas. The iodides were given for some time at the dose of 10 grams a day and locally a 10 per cent. balsam of Peru ointment was used, or with red precipitate ointment. Healing was rapid and good.

It must be admitted that here the process which had prevented healing had been removed and on the 12th of September, 1902, the cure was complete. As a precautionary measure, however, the patient was advised to continue large doses of iodide over an extended period. From this time on the patient has remained well and neither subjective symptoms, nor objective changes, have been discovered. Later on, a thorough and detailed investigation was carried out in order to ascertain if there had been syphilitic infection, but no good ground for a diagnosis of syphilis could be obtained. From the history of the operation alone, a suspicion arose that the process was luetic and in point of fact, on account of the delay in the process of repair, as well as the ulcerative processes in the region of the otherwise clean granulating wound, this was quite plausible. Indeed, when inunctions, combined with large doses of the iodides had been exhibited, they proved to be inactive, and it was only when 10 grams or more had been reached, that any positive result was obtained. This case clearly teaches that in all those instances where the process of repair is slow without any definite cause, lues should be suspected.

A very interesting case of gummatous joint inflammation has been recorded by J. A. Rosenberger in 1900, the case having been considered as tuberculosis and treated accordingly for years. The patient, a female, claimed that the affection dated from an accident. On September 28, 1892, she noticed a perceptible and peculiar creaking sound at the time of injury on the inner aspect of the knee joint. The joint swelled and became painful. She continued her work for a few days, but was obliged to leave off and went to the hospital, from which she was discharged improved. As the cure was not complete she went to other hospitals during the following years. As her mother had died of pulmonary tuberculosis, the patient was considered as having chronic tuberculous inflammation

of the knee joint due to traumatism. Treatment consisted of rest in bed, poultices, massage, intra-articular iodoform injections, application of a plaster cast and six incisions followed by curetting. The patient married in 1897, but had never given birth to a child.

On December 11, 1898, she consulted Rosenberger for the first time. The knee joint, which felt hot, was 3.8 cm. larger than its fellow, while on the inner aspect, fluctuation was detected and pressure gave rise to pain. Under the knee joint were several white shiny radiating cicatrices, in which were some irregular thickenings and bridge-like adhesions, and which gave rise to a suspicion of syphilis. For this reason specific treatment was advised.

The patient then went to a hospital, which, however, she soon left, after pus had been evacuated by exploratory puncture. She had refused operation.

On November 7, 1899, the patient was again seen by Rosenberger. Above the lower epiphysis of the femur on the inner aspect, a large fluctuating tumor was found, measuring 8 cm. in length and 7 cm. in width; it was not painful on pressure. Ten cm. above the upper border of the patella another hard tumor, 10 cm. in length was found, which extended to the extent of 16 cm. across the thigh. This was likewise practically painless and only at one spot, which was about at the middle, could an indistinct fluctuation be made out. There was no rise in temperature. On account of the long duration of the affection, as well as the presence of the peculiar cicatrices, a diagnosis of syphilis was made. The joint was freely movable, whereas, had it been tuberculous, it would have healed with considerable lack of motion, or it would have led to general debility, if not to amputation. Therefore, no operation was considered necessary, but antisyphilitic treatment was started. After the administration of the iodides, the swelling vanished completely in about eight weeks and consequently the diagnosis was verified. Since then the joint is quite normal, perfectly movable, in spite of the defect resulting from the degenerated syphiloma on the upper extremity of the tibia. Because the joint became easily tired and slight swelling resulted after exertion, the patient was seen occasionally, but improvement from these symptoms appears impossible.

This case is interesting, not only because a syphilitic process

had been mistaken for one of tuberculous nature, but especially because it apparently depended directly upon traumatism. The questions arise first; did a syphilitic inflammation of the knee joint already exist when the traumatism occurred, having given rise to no symptoms; secondly, independently of the traumatism, would a syphilitic inflammation of the joint have taken place, and thirdly, was the traumatism the direct cause in producing manifestations of latent syphilis? These questions can not be answered and probably could not have been assumed even if a correct diagnosis had been made shortly after the accident, consequently they are of little import here. The only question that can be discussed is whether traumatism can be a direct cause in producing manifestations of latent syphilis? In reply to this it would seem quite justifiable to admit that the traumatism acted here just as it might act in the case of the development of a tuberculous process of a joint, and, consequently, it is quite permissible to admit the possibility of traumatism as an etiological factor for the development of luetic joint disease. This, I believe, has a certain medico-legal importance. The following case would seem to support these views.

A male, 48 years of age, was struck on November 24, 1899, on the right knee with an iron rail. The latter was being handed down to him while working on a wharf, one end sliding off upon the patient's knee. The joint became very painful and swollen. A fortnight later, some small reddish spots appeared on the inner side, while at the same time pain occurred. Examination showed numerous spots of leucoderma, particularly marked over the bone. Otherwise, there were no evidences of syphilis. There was no effusion in the joint. On the inner aspect and in front were several small, round and superficial ulcers, covered with yellowish crusts and surrounded by a somewhat reddish area. At the back of the knee, toward the inner aspect, the skin was discolored a reddish brown at some points and was swollen and infiltrated. There was no tenderness on pressure. In the infiltration some spots, irregular in outline, could be detected. These were connected by less infiltrated tissue. At some places distinct fluctuation could be made out in the nodules. The entire infiltrated portions of the integument were excised and healing progressed favorably with the internal administration of the iodides. It would appear that in

this case the development of a gummatous process in the skin may be considered as a direct result of the traumatism.

As we have seen, syphilis can occur in so many different disguises that errors in diagnosis are apt to occur, especially in those cases where there is tumor formation. If there are several syphilomata present, the diagnosis will probably be correct, but if there is only a single one, if the patient is of that age at which malignant neoplasms are not infrequent and when there are no signs of a former infection, a diagnosis is difficult to make, for the simple reason that the characteristic sign of these forms of late syphilis are lacking. To quote Langenbeck: "It is of the utmost importance to find means by which one will be able to recognize gummatous tumors with certainty, but which will be all the more difficult, because there are few characteristic signs, and, unfortunately, it must be admitted that neither the external aspect of the tumor, nor the objective and subjective symptoms, prevent one from making erroneous diagnoses. Besides this, the macroscopic and microscopic findings of the growth when extirpated are not always so characteristic as to prevent error," and in this latter remark I thoroughly agree. Virchow, as far back as 1858, says: "Specific elements, and such a constant makeup by which one could always make correct diagnosis, are not present in gummata. As the single elements in which the inherent tendency to early degeneration is more characteristic than the form and development of the cells themselves, so the formation and the entire arrangement of the nodules is more suggestive of syphilis than their structure."

From all this it follows that it is most essential in all doubtful cases to obtain an exact history and to endeavor to find evidences of a former syphilis. In many of the reported cases which have been operated upon on account of an erroneous diagnosis, syphilis was found afterwards, when a careful examination had been made. It is evident that when looking for such signs some small cicatrix which was considered as insignificant before the operation may in reality turn out to be a most important bit of evidence after the operation has been done. Of course, the cachectic appearance of the patient alone, may justify one to a certain extent in making a diagnosis of malignant new growth, as I have already pointed out.

If, from the history and examination, some grounds are found

for believing that there has been a former luetic infection, then in all probability the tumor is a syphiloma. Under these circumstances mercurial inunctions and massive doses of the iodides internally, should be prescribed, but I insist upon the fact that both must be pushed as far as possible in order to obtain any result, because, otherwise, small doses will be sure to result in failure to obtain any action over the process. If, by large doses, there is no improvement, the diagnosis of a malignant neoplasm becomes almost a certainty and an exploratory operation, followed by a microscopical examination, should at once be resorted to. If, even then, the growth gives evidence of a gummatous character a radical operation may be undertaken, which should be followed by a rigid antisyphilitic treatment. In those cases where from the history and clinically no syphilitic evidence can be obtained, one must then determine whether the condition of the patient will warrant awaiting the result of antisyphilitic treatment. If, however, there is any doubt as to losing too much time from this, an exploratory incision should be undertaken. I believe that Esmarch is quite right when he says: "When there is a question of large, destructive and serious operations I believe that much freer surgical interference is permissible, or even necessary for diagnostic purposes."

As to the question of how long an antisyphilitic treatment should be continued in order to decide the nature of the case, it should be recalled that mercury and the iodides do not always show any action for a few days and that sometimes weeks and even months may be necessary in order to show any improvement. Relative to this point Langenbeck says: "I should advise applying this treatment only in those cases where there is a possibility of the tumor being gummatous, and to interrupt it, if, after from eight to fourteen days, there is no marked improvement. I have seen in cases of carcinoma, especially of the tongue, a more rapid extension and degeneration of the tumor as a result of inunctions, although at first the growth appeared to be favorably influenced by them." I can heartily concur in this statement, as upon several occasions I have witnessed the bad effects of mercury and the iodides in malignant neoplasms. About a fortnight of antisyphilitic treatment appears to be enough to allow one in most cases to recognize

the specific, or non-specific character of the growth, provided the treatment is intense and where there has been no improvement within this time, it is a question whether or not one should wait longer. Since the use of mercury or the iodides alone often proves insufficient for diagnostic purposes, both drugs should be administered at the same time. That carcinoma and syphilis are often found together in the same patient is a well-known fact, and this should always be borne in mind.

Syphilis is an affection frequently giving rise to ulcerative processes, with their resulting cicatrices, and since old scars are a favorite site for the development of carcinoma, it at once becomes evident that the latter process may develop in the cicatrices left by syphilitic ulcers. According to Kaposi, the development of carcinoma has been observed with frightful frequency from the epithelial layers of patches of leucoplacia on the tongue and mucous membrane of the mouth and he says: "It is not a true syphilitic production which has transformed into a carcinoma, and syphilitic diathesis is in itself not a predisposing factor for carcinoma, because this may be considered as having disappeared usually at the period of the development of these excessive keratoses. Here, as in other places, and under other pathological conditions, such as warts, granulating wounds, etc., the proliferating epithelium, which is the starting point for the atypical epithelial formation and with it carcinoma, is found."

It is quite worthy of note that a series of cases has been published in which the clinical and histological characters of an uninjured or ulcerated syphiloma have become transformed into carcinoma.

PSEUDO-MYXOMA PERITONEI IN A MAN, SECONDARY TO CYSTIC DISEASE OF THE APPENDIX

BY GUTHRIE McCONNELL, M.D.

From the Laboratory of the St. Louis Skin and Cancer Hospital

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Cases of pseudo-myxoma peritonei in women are sufficiently uncommon to bring them into the category of the interesting and unusual. Such a condition in a man is practically unknown, there being so far as I can determine, only two other cases similar to the one now reported.

The condition is also of interest on account of its bearing upon primary colloid carcinomata and mucoid cysts of the appendix. Stengel [1] reviews the literature of cystic conditions of the appendix very thoroughly and the following references as relating to the present case have been taken from that paper. Wenzel-Gruber [2] describes a case in which the distal end of the appendix was dilated, the serosa thickened, the muscularis hypertrophied and the mucosa convoluted. The cyst was filled with viscid, glary mucus. There was an opening, though small, into the cæcum. Feré [3] reports a case of a mucocele in the middle portion of the appendix in communication with a fluctuating tumor projecting into the cæcum. It contained a colorless, gelatinous mass resembling boiled starch. Mayland [4] describes what he calls a retention cyst of the appendix, the distal portion of which was dilated and filled with a clear gelatinous substance. He also makes mention of a similar case reported by Coats.[5] Shoemaker reports a case, found post-mortem, in which there was a cyst containing a clear jelly-like mass. Coats [6] mentions a case in which the appendix had been converted into a large cyst, measuring five inches in its long diameter. The cyst contained a tenacious material and the wall was thick and firm. Wien [7] reports a case of cystic degeneration of the appendix, which caused a tumor in the right iliac fossa. There was great swelling along the crest of the ilium, and an opening near the posterior spine from which three or four ounces of quite clear mucus, occasionally

stained with pus, escaped daily. The discharge was said to look almost exactly like the vitreous humor.

Stengel [8] concludes that the above cases are most probably instances of retention cysts due to inflammatory conditions. That, however, does not seem to hold good in the majority, as in those reports where note is made of it, the appendix is described as being free from adhesions. If there had been any marked adhesions it is probable that mention would have been made of the fact.

Rokitansky [9] reported four cases of supposed colloid cancer in which the gross appearance was that of cysts of the appendix. In his series the appendix was transformed into a thick-walled cyst filled with a whitish-yellow gelatinous substance, supported in two cases by a fine reticular net-work, with small rudimentary blood vessels visible in places. After much discussion Rokitansky comes to the conclusion that this affection is a colloid cancerous degeneration of the appendix, and that the tension of the mass of gelatinous carcinomatous material causes a dilatation of the walls of the vermiform appendix, with a consequent transformation into a fibrous capsule. Draper [10] reported a case of colloid cancer of the appendix. "The upper third or head of the appendix was enlarged and dilated to such a degree that externally it was of the size and shape of a large plum; its cavity, deeply injected, was irregular in its surface and would admit the little finger. The opening from the appendix to the intestine was also dilated. The thickened wall of this enlargement presented the characteristic appearances of colloid disease. Vimont [11] reports a case of mucocele of the appendix found at the autopsy on a woman who had been operated upon for bilateral gelatinous cysts of the ovary, which had ruptured into the peritoneal cavity. The tip of the appendix was attached to the uterine cornua. The contents of the cyst were gelatinous, like boiled starch and weighed 38 grams. The walls of the appendix were thickened, whitish, and at one place presented two small papillomatous masses. (This condition may have been secondary to the ovarian disease. G. McC.) Baillet [12] describes a cyst of the appendix found during an operation performed to remove a papillomatous ovarian cyst. The opening into the cæcum was occluded. The cyst was found to be made up of mucoid tissue, imbedded in which were many large cavities lined with non-ciliated cylindrical epithelium.

Stengel's [15] case was an appendiceal cyst found at autopsy. "The appendix was found greatly distended in a somewhat cystic fashion, and at one point a small hernious protrusion of the mucosa, through a defect in the serous and muscular coats, causing a clear vesicular projection of about the size of a grape seed, was discovered. The cæcal opening was occluded. The cyst contents were of a whitish or opalescent character. Microscopic examination showed the mucosa to be nowhere intact. In its place was found a layer of varying thickness, composed of polymorphous epithelial cells without definite arrangement. Generally this epithelial lining was thin and in some places wanting; in a few places it was more massive and at such places there could be traced into the gelatinous cyst contents, irregular extensions of columns or strata of epithelial cells. Closer study and, in particular, the discovery of irregular acini, epithelial tubular structures, and collections of epithelial cells scattered everywhere through the gelatinous substance lead to the suspicion that the condition might be allied to colloid carcinoma."

It would seem to me that all of the above cases might be considered as representing varying degrees of practically the same condition. It does not seem plausible to consider the apparently simple mucoceles as being purely inflammatory. The latter cases, simulating to a certain extent colloid carcinomata, are evidently of a neoplastic character. The condition with which these formations seem analogous is that of the pseudo-mucin cyst of the ovary. The structure of the appendiceal cysts, particularly those described by Rokitansky, Draper, Vimont, Baillet, and Stengel, resemble rather closely the formation of multi-locular cysts. Wien's case in which there was a constant discharge of mucoid material would seem to be more truly cystic in character than simply inflammatory. The fact also that these cases have been in nearly every instance discovered accidentally and that there has been little or no involvement of the neighboring tissues indicates a very low grade of malignancy. As is well known the pseudo-mucin cysts of the ovary, although not giving metastases, may nevertheless give rise to secondary mucin cysts if the primary growth ruptures into the peritoneal cavity. It would appear therefore that in the majority of the above cases we are dealing with a true cystic degeneration of the appendix, which at the same time has a malignant tendency about equal to that of

the pseudo-mucin cysts of the ovary. Such formation would come under the category of adeno-cystomata of the appendix.

The following two cases in connection with my own furnish the connecting link in the resemblance of the appendicular adeno-cystomata with similar conditions of the ovary. Fraenkel [14] in an autopsy on a man 79 years old found free colloid material deep in the abdominal cavity. Upon removing this the peritoneum was found to show a marked velvety appearance. As the source of the jelly-like substance he found what he called a ruptured Hydrops spurius of the appendix; a small perforation was present. The microscopic examination showed the peritoneum at the site of the colloid masses to be covered with small villi. These contained branching vessels and were covered by the endothelium of the peritoneum. Encapsulating connective tissue membranes, such as are observed in pseudo-myxoma peritonei, were absent.

Lubarsch [15] refers to a more characteristic case in a 69 year old man following the rupture of a Hydrops spurius of the appendix. The macroscopic and microscopic findings presented a wonderful resemblance to the usual picture of pseudo-myxoma peritonei. As a result of the penetration of the gelatinous masses they were in some instances completely encapsulated by bands of the subserous connective tissue in which were blood vessels. Wherever the cells covering the peritoneum remained under the gelatinous masses there was occasionally seen a distinct transformation into cubical and even cylindrical forms.

The following case is reported very fully and one can readily see that in every respect it is identical with the condition known as pseudo-myxoma peritonei although the origin was unmistakably appendiceal.

W. G., 50 years old. Male; white. Was admitted to the St. Louis Skin and Cancer Hospital May 4, 1907. Service of Dr. N. B. Carson. Family and past history negative except that in past years had been a hard drinker.

Present history dates back five months at which time patient noticed a shortness of breath. This became progressively worse so that he could no longer work. Was obliged to go to bed on account of the dyspnœa. Next noticed that his abdomen began to swell. Other than these two things the patient has noticed nothing.

Became weaker and thinks that he has lost weight but does not know how much. Noticed an inguinal hernia first five months ago. Appetite poor, bowels stubbornly constipated since the onset of his illness. Has never vomited. Does not think that his stools have ever contained blood. Movements usually thin and watery, the result of salts that he has taken every day since December. Feet have been swollen for the past three weeks.

Physical Examination.—General condition is poor, emaciated and complexion sallow. Teeth and gums in poor condition. Chest: Anteriorly there is a rather marked bulging of the right chest with a retraction of the intercostal spaces on both sides. Percussion note over both chests is markedly tympanitic. Right chest flat in the axillary line from second interspace to the costal margin. Left chest gives a fairly good resonant note along the mid-axillary line. Breath sounds over the left chest normal except for a prolonged high pitched expiration. Sibilant and sonorous râles irregularly scattered. Breathing over the right chest diminished from third space down to free border. In upper three spaces the breathing is almost tubular in character. Absence of breathing in right axillary line. Diminished breathing in left axillary line with a few dry râles. Posteriorly: left side, vesicular tympanitic percussion note from apex to base. Breath sounds rough and harsh, numerous coarse râles. Right chest, flatness beginning three fingers above the angle of the scapula extending to base. Line of flatness depressed about two fingers on deep inspiration. From apex down to line of flatness breath sounds are diminished in volume. Below line of flatness is an absence of breath sounds. Voice sounds are normal above the line of flatness. At the line of flatness there is egophony. Below this point is an absence of voice sounds. Fremitus is increased over the upper part of the right chest and is absent below the line of flatness.

Heart: Is impossible to map out the borders owing to the emphysema. The fourth, fifth, and sixth spaces seem to retract synchronously with the apex beat. Sounds at the apex are normal, slight exaggeration of the aortic second. Pulse shows slight increase in tension.

Abdomen: Is symmetrically distended, flat percussion note over all. Does not change on change of position of the patient. Is im-

possible to palpate kidneys or liver or spleen or to mark out the liver satisfactorily by percussion. The entire epigastrium is occupied by a hard nodular, insensitive mass. Similar masses are situated in both flanks and numerous smaller ones are scattered around irregularly in the abdomen. A loop of gut can often be made out lying over these masses and escaping from the overlying finger with a gurgle. No fluid wave. No caput medusæ, no œdema of the abdominal parieties or pouting of the umbilicus.

Rectum: Indefinite, irregular mass filling out the whole true pelvis. Prolapse of the rectal mucous membrane.

Scrotum: The entire right side of the scrotum is filled with a mass about the size of a man's fist. Is irreducible, not tender, no impulse on coughing.

For the above notes on the case I wish to thank Dr. M. G. Seelig.

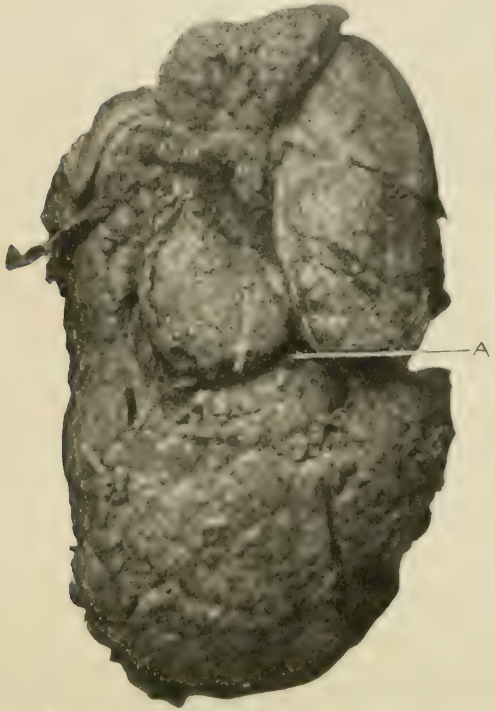
The patient died on the 18th of June, 1907. The following are the notes of the autopsy.

Heart 360 grams, left lung 380, right lung 315, left kidney 115, right kidney 125, thyroid gland 45.

The body was that of a much emaciated adult white male. Abdomen much distended by a firm mass. The right side of the scrotum is enlarged to about the size of a man's fist, is quite tense. Protruding from the rectum was a dark brownish mass about 15 cm. in diameter. On the posterior surface of this mass was a small opening that proved to be the external opening of the bowel. Over both posterior superior spines were small ulcerated areas.

The abdominal wall was about 0.25 cm. thick. On opening the cavity there escaped between 200 and 300 c.c. of a slightly cloudy yellowish fluid. None of the abdominal organs were visible as they were concealed by a greatly thickened and enlarged omentum. This was pale yellowish and white in patches and consisted of circumscribed collections of a soft gelatinous material that readily escaped when the containing connective tissue wall was ruptured. This mass extended from the lower border of the stomach down into the pelvis and laterally to the mid-axillary lines. The inner surface of the abdominal wall was in its great extent covered by masses of the gelatinous growth. In some places was present over large areas while in others it appeared as scattered drops. A narrow strip, about 3 cm. wide, of the anterior wall of the stomach was free but

Fig. 1.

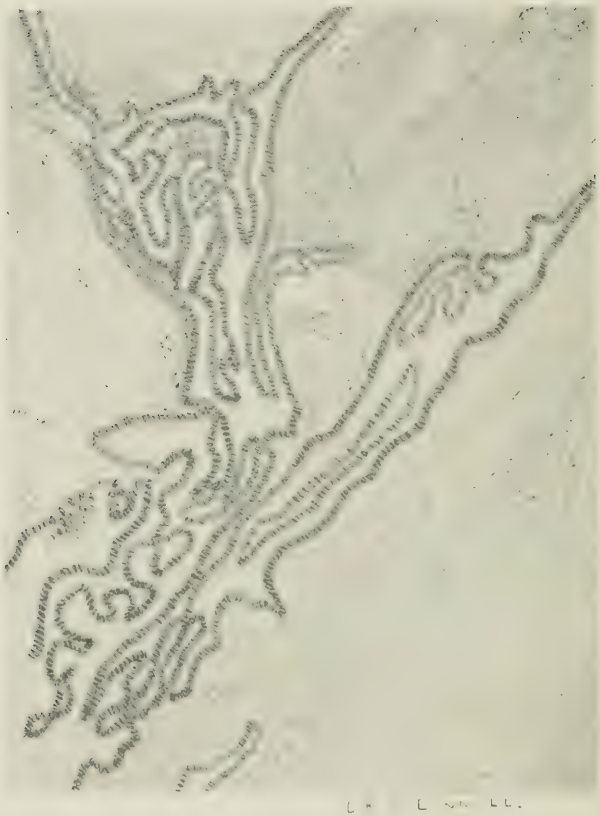


Anterior view showing the greatly thickened omentum and (A) the situation of the stomach.

Fig. 2.

Posterior view showing (A) liver surrounded by a myxomatous mass; (B) appendiceal tumor cut open longitudinally.

Fig. 3.



Section from appendix showing adenomatous formation. Oc, 2. Ob, 4.

a mass of similar structure to the omental tumor extended upward, on the right side to the lower border of the third rib and on the left to the lower border of the fourth. On the left side the spleen was found to be imbedded within the tumor mass. On elevating the omental mass the coils of the small intestine were found to be greenish black in color and matted together by recent fibrinous adhesions. The large intestines were almost completely enclosed in masses of the gelatinous substance. Extending from the caput coli was a tumor about 5 cm. long and 3 cm. in thickness. This was much firmer than any other portion of the growth. On opening it longitudinally there was found a dilated cavity about 1 cm. in diameter and 4 cm. long. This was lined by a smooth thin membrane through which, near the distal end, there was a small opening about the size of a pin's head communicating with the surrounding mass. This cavity was filled with a very thick, tenacious, jelly-like material, and communicated with the cæcum by means of a small opening through which a probe could be passed. This cavity was evidently the appendix.

Liver: The liver was completely enclosed in a mass of gelatinous growth, the covering varying in thickness from 2 to 5 cm. In many places the surface of the liver was quite deeply pitted from the pressure of the cystic formations. No secondary growths were present. The organ was dark brown with small yellowish areas. The gall-bladder was not completely covered, was apparently normal, and contained some yellowish viscid bile.

Kidneys were free from any neoplastic tissue, was no peri-renal fat. Capsule stripped easily leaving a perfectly smooth surface. Macroscopically they appeared normal.

Stomach was almost completely surrounded by the tumor mass but the mucosa was entirely free from any involvement.

Lungs: Both pleural cavities contained some yellow fluid, the left side more than the right. On the right side the diaphragm extended to the lower border of the third rib, on the left side to the lower border of the fourth. The lower lobe of the right lung was compressed and completely airless, the upper lobe was much compressed but contained some air. The posterior portion of the lower lobe of the left lung was compressed but the greater part was slightly emphysematous. Both lungs contained considerable pigment.

Heart: Small amount of fluid in the pericardial sac which was smooth and free from any growth. The apex of the heart was quite rounded, due to a marked increase in the thickness of the left ventricular wall. The valves appeared normal. A few irregular yellowish areas of atheroma were present along the aorta.

Scrotum: The right tunica vaginalis was greatly distended by a loose mass of soft jelly-like material, slightly blood stained. Similar collections, though much smaller, were present near the internal ring. The tunica was greatly thickened and its inner surface was covered by many small hæmorrhagic areas. On one side of the tunica was an area of thickening about 6 cm. long, 2.5 cm. wide and 1 cm. thick. On cutting into this mass it was found to be composed of a loose spongy tissue, evidently testicular in character.

Rectum: The rectal protruberance was composed of the loose tissues that had been forced outward by the pressure of the growth and the fluid that was within the abdominal cavity. Were some free masses of the gelatinous material in the swelling.

Microscopic Examination.—Specimen from the appendicular tumor. One element of the specimen consists of a homogenous, slightly granular material that is evidently connective tissue in a state of œdema or myxomatous degeneration. In it are found a few large vesicular nuclei and a great many polymorphonuclear leucocytes, many lymphocytes and a few eosinophiles, some plasma cells are also found. In a few areas there are many small and poorly formed capillaries, but the vascular supply is very scanty. In some regions a fibrillar structure in the tissue is apparent. As the nuclei in such places are long, narrow and rod-shaped they are probably the nuclei of the involuntary muscle fibres. In addition to the above structures there are many very decidedly convoluted and complicated tubules extending into the surrounding tissues. In some instances these tubules have become greatly enlarged, circular in shape and filled with a stringy substance that stains faintly with hematoxylin. Lining these tubules and acini is, as a rule, a single layer of columnar epithelium. The nuclei are round or oval, are situated at the base of the cell and in no case do they appear to have broken into the surrounding tissue. The outer two-thirds of the cell is composed of an almost transparent, slightly granular material that in the case of the cysts fills the cavity.

Appendix, section B: In this specimen there is quite a large amount of fibrillar connective tissue in which are many large blood vessels. In some areas the connective tissue appears more homogeneous and contains many cavities irregular in size and shape, that are filled with a stringy, semi-transparent mass slightly staining with hematoxylin. In most of these cavities, both large and small, there are no traces of a lining membrane. In some, however, there is found a layer of round or oval, rather deeply staining nuclei in cells varying from the cuboidal to the columnar. Small collections of cells are also found lying free within the cyst cavities in some instances. One or two areas show a small group of complicated tubular arrangements of the acini.

The sections taken from various portions of the larger masses show a practically similar structure. There are many narrow connective tissue bands dividing the growth into multilocular cysts. These cysts are filled with a stringy gelatinous substance staining faintly with hematoxylin. In the great majority of instances no remnant of epithelium can be found on the walls of the cysts. Occasionally a small collection of distinctly columnar cells can be seen either lining the connective tissue walls or lying free within the cyst contents.

Liver: The tissue with one exception shows very little change other than a cloudy swelling and less blood in the capillaries than normal. In one area, however, that portion immediately underlying the surface that was pressed upon by the tumor formation shows certain definite changes. The capsule is considerably thickened and the underlying cells are crowded together. The nuclei of the liver cells vary greatly in size and staining power. Some take the hematoxylin very deeply while others are pale and vesicular.

Tunica vaginalis: The tunica is considerably thickened by an increase in the amount of connective tissue which contains comparatively few nuclei. In some areas the connective tissue fibres are very loosely arranged and in many of these localities a marked interstitial hæmorrhage has taken place. Scattered throughout the tissue is a large amount of pigment found both intra- and extra-cellular, evidently hæmatogenous. The hæmorrhages seem rather larger and more marked along the internal surface of the tunica rather than within the tissue. Just a little below the surface are found numer-

ous small cystic areas filled with the same fibrillar homogeneous substance staining slightly with hematoxylin. In one or two places a small mass of cells, resembling those lining the cyst wall, are to be found.

Thyroid gland: The specimen consists of a net-work of connective tissue strands of varying thickness enclosing acini that differ greatly in size but that are more or less oval or round in shape. These openings are filled with a homogeneous translucent material that stains deeply with eosin. The connective tissue stroma in many places contains large numbers of cells, evidently those forming the lining of the acini. Numerous small capillaries are also present.

The gelatinous substance found in the new growth instead of staining by the eosin shows an affinity for the hematoxylin, is therefore probably not colloid. From its general characteristics it is more like pseudo-mucin. It also does not stain red with Van Gieson's.

Conclusion.—From a careful consideration of the foregoing cases it would seem evident that there are many instances of so-called colloid carcinomata of the appendix that do not properly come under that classification. They have, as a rule, been discovered accidentally, there have been no symptoms nor have they given metastases. In other words they have practically none of the attributes of malignant disease, yet as indicated in the cases reported by Lubarsch and myself there is a tendency for growth to occur if the cells are mechanically implanted elsewhere.

The cases also of the mucoceles are not explained in the majority of instances by claiming an inflammatory origin for them. In many there have been reported distinct evidences of a cellular proliferation with an attempt at cyst formation.

Both these above classes, it would seem to me, should be considered as varying degrees of a third, that of cystic adenomata of the appendix.

In the above there have been reported all degrees of cystic formation from that of an indefinite acinar arrangement to that of well developed cysts surrounded by distinct connective tissue walls. These walls in many cases being covered by quite well developed cuboidal and columnar epithelium.

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REPORT OF CASES OF PERFORATION IN TYPHOID FEVER OPERATED UPON AT THE PENNSYLVANIA HOSPITAL

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Dr. Scott, in his article on The Study of Fifty Cases of Perforation in Typhoid Fever,[1] and in his recent article on A Further Study of Perforation of the Bowel in Typhoid Fever,[2] treats in such an exhaustive manner the various symptoms of perforations that little or nothing is left to be said on this portion of the subject, and I shall therefore confine this paper to a few remarks on the method of treatment of these cases as practiced at the Pennsylvania Hospital, and give a brief report of the cases operated upon for this condition up to the present time in that institution.

The only treatment for this complication of typhoid is immediate operation, and were it possible to carry out this treatment as soon as the diagnosis was made, or even suspected, a larger percentage of recoveries would surely be the result. The chief and first difficulty is the diagnosing of this condition, and secondly, especially in hospital work, consent for such an operative procedure is often with difficulty obtained. However, I believe the rule to follow is to operate as soon as possible in all positive cases; in fact in all cases, even if all the symptoms are not present, but in which there are sufficient symptoms to make the case suspicious. In other words, operate in all cases in which perforation is suspected, and never wait for the advanced symptoms of this condition, which are merely those of a general peritonitis. Should operation be postponed in every case until the diagnosis is positive, much valuable time will be lost, and many valuable lives sacrificed.

It is the custom at the Pennsylvania Hospital to use a general anæsthetic in these cases, but one or two have been done under

[1] *University of Pa. Medical Bulletin*, May and June, 1905.

[2] *New York Medical Journal*, February 9, 1907.

local anæsthesia, and several under spinal anæsthesia, but ether preceded by ethyl chloride or ether alone has been the method most used. But a small quantity of ether is required, and I have frequently noticed that when well given, it has a stimulating effect rather than a depressing one, as would be supposed. The cases are either placed on the operating table before the anæsthetic is started, or else before they are entirely under its effect. The incision is always made in the right side, formerly over the semilunar line, but of late over the outer border of the rectus. The incision is carried through the anterior sheath of the rectus, the fibers of this muscle are then separated, or drawn inward toward the median line, and then the abdominal cavity opened by dividing the posterior sheath and the peritoneum. The incision should be long enough to allow a speedy and thorough examination of the abdominal contents. Usually upon opening the abdominal cavity the correctness of the diagnosis is at once made apparent by the inflamed condition of the bowel or by the escape of serous fluid and fæcal matter. However, this is not always the case, as in one of my own cases it took several minutes' search to find the perforation, as there were no signs of peritonitis visible upon opening the abdomen, and none noticeable except within an inch or two of the perforation.

Immediately upon opening the abdomen a search for the cause of the trouble should be made. As this usually is found in the first fifteen or eighteen inches of the ilium, the ilium should be sought at its juncture with the cæcum, and examination of the small bowel should commence at this point. As soon as the perforation is located it should be closed at once, and a further exploration made for other perforations. It is usually the case, that if there is more than one perforation it will be found within a short distance of the first one, so the examination of a foot or two of the bowel from the site of first perforation found is usually sufficient. Sometimes a number of perforations are found, if the condition of the patient will stand it these should be closed, the same as the first, but where it will require too much time to close these various openings it is much better to be satisfied with the packing off of the whole portion of gut from the general peritoneal cavity, and allowing it to drain into the wound.

In closing the perforation, either mattress sutures or Lembert

sutures of catgut, silk or Pagenstecher thread is used. Care must be taken where the perforation is a large one, or where there is extensive induration around the ulcer, not to interfere too much with the lumen of the gut in closing the opening, as stricture is likely to result.

After the perforation has been closed the question of flushing or merely wiping the abdomen must be decided. Where there has been free leakage of bowel contents, or where there is an extensive peritonitis with fluid all through the abdominal cavity, it seems most rational to resort to free and thorough flushing. However, if the extravasated fluid is confined to the site of perforation, and to the pelvis alone, it is the better plan to mop out the fluid with dry sponges, rather than to resort to free irrigation and run the risk of disseminating the virulent matter to the portions of the abdomen which have not been involved.

The remainder of the operation consists in introducing drainage and closing part of the wound. In the cases to be reported gauze drainage, sometimes with the addition of a rubber tube into the pelvis, was used. A drain should always be placed so as to drain the deepest portion of the pelvis and another at the site of perforation. When the wound is in the outer portion of the rectus muscle it will seldom be found necessary to use any sutures to close the external wound, as wounds in this position usually close themselves without the aid of sutures, in fact, in many instances it is with great difficulty that they are kept open for the sake of drainage. Hernia is less likely than when the incision is made through the semilunar line.

The various steps of this operation which have just been described should be done as quickly and thoroughly as possible, fifteen or twenty minutes usually being sufficient time for these procedures.

The method of operation and the time occupied are important factors in these cases of perforation, but the after-treatment is just as important, if not more so. If vomiting has been one of the symptoms before operation, it is a good plan to wash out the stomach before the patient recovers from the anæsthetic. If the condition of the patient will warrant it, the Fowler position and the Murphy treatment should be adopted. I think, however, very few

of the cases will stand the extreme Fowler position, for the reason that they have been ill several weeks at least, lying on the flat of their backs, and this new position means too much extra exertion on the already weakened heart. It has been the custom at the Pennsylvania Hospital to raise the head of the bed in these cases so that the peritoneal cavity would drain into the pelvis, and not place them in the exaggerated Fowler position.

Constant enterocylsis, as advised by Murphy, should be given for the first forty-eight or seventy hours, unless the bowel is unretentive, when salt solution in small amount, six to eight ounces, may be given per rectum every four or six hours. If there is no vomiting the first twelve hours, water in small quantities may be given by the mouth. All stimulation during this time should be given hypodermically. Food should not be given for at least forty-eight hours, and then should be started in very small quantities.

As there is usually a large amount of drainage from these cases, it is necessary to change the dressing several times during the first few days, the gauze drains themselves should be allowed to remain at least four days and then be removed gradually, and it is also far better to wait for them to loosen themselves than to exert too much force in their removal.

REPORT OF CASES

The first case was operated upon by Dr. LeConte [3] December, 1896, and was diagnosed appendicitis, but upon opening the abdomen free serous fluid was found in the cavity, considerable lymph on the intestines and a number of necrotic spots on the ilium, cæcum and ascending colon which seemed about to perforate. The whole region containing the necrotic patches was walled off from the general abdominal cavity and the wound allowed to remain wide open. In thirty-six hours a fæcal fistula developed, but this closed in four weeks' time and the patient made an uninterrupted recovery. In this series of cases, it is the only one operated upon in what is called the preperforative stage, and which afterwards perforated.

In this preperforative class might also be mentioned two cases to be considered with those, where the condition other than perforation was the cause of the symptoms, but in which a general perito-

[3] *Annals of Surgery*, vol. xxxiii, 1901.

nitis, together with several necrotic ulcers apparently about to perforate, were found.

Up to the present time there have been ninety-three cases operated upon for perforation at the Pennsylvania Hospital, and in this number seventy-four were found to have perforations. In nineteen cases no perforation was found. Of the seventy-four cases sixty-one were males and thirteen were females. Seventeen of the seventy-four cases recovered and fifty-six died, making a mortality of 77.0 per cent and the percentage of recoveries 22.95 per cent. Of the recoveries, sixteen were males and one a female.

This number of recoveries does not include a number of cases which might be included under the head of operative recoveries, but which died later of some other cause than perforation. For instance, two cases lived nine and fifteen days respectively and then died of cardiac failure and in both of these cases the abdominal condition apparently had nothing to do with the immediate cause of death. One case also died of a second perforation nine days after the first operation.

The ages of the patients in which perforation were found varied considerably, the youngest being seven years of age the oldest fifty-seven. The greatest number of perforations occurred between the ages of twenty-five and thirty, there being seventeen of these.

The following table shows in detail the ages at which the perforation occurred:

TABLE 1.

5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	57
4	7	7	12	15	9	11	4	3	1	1

In sixty-nine of these seventy-four cases there was but one perforation found, sixty-two being located in the first eighteen inches of the ilium, while in seven cases the opening was found in the first three feet of the ilium. In three cases the site of perforation was in the cæcum, while the ascending and the transverse colon was each the situation of one perforation. In five of the series more than one opening was found, the greatest number in a single case being five, all of which were located in the first eighteen inches of the ilium.

The majority of the cases perforated in the third week, there being twenty-eight of these.

In seventeen cases that recovered nine perforated in the second and third week of the disease, and the average time between the onset of symptoms to the time of operation was eleven hours.

Of the nineteen cases operated upon and in which no perforation was found, eleven died and eight recovered, a mortality of 57.89 per cent. In seven of these cases no cause whatever was found to account for the symptoms of perforation, four of the seven died and three recovered. Of the four that died, two died the same day as operation, one lived three days, while the fourth lived six days and died of toxæmia.

Table 2 shows number of cases operated upon for perforation, but in which no perforation was found.

TABLE 2.

Causes.	Total Number.	Recovered.	Died.
No cause found	7	3	4
Pneumonia	3	1	2
Appendicitis	3	1	2
General Typhoid Peritonitis	4	1	3
Ruptured Mesenteric Glands	1	1	0
Phlebitis	1	1	0
	19	8	11

Table 3 gives the number of cases operated upon each year for perforation and the results.

TABLE 3.

Year.	Perforative Cases.	Non Perforative Cases.	Cases of Perforation to Recover.	Deaths in Perforative Cases.	Recoveries of Non Perforative Cases.	Deaths of Non Perforative Cases.	Total Number of Typhoid Cases in Hospital.
1896	1	0	1	0	0	0	161
1897	0	0	0	0	0	0	149
1898	3	0	0	3	0	0	213
1899	0	0	0	0	0	0	654
1900	1	0	0	1	0	0	330
1901	6	2	0	6	0	2	
1902	9	0	4	5	0	0	509
1903	19	6	6	13	4	2	746
1904	7	3	1	6	0	3	690
1905	6	3	0	6	2	1	462
1906	14	3	2	12	2	1	596
1907	8	2	3	5	0	2	
Total	74	19	17	57	8	11	

TUBERCULOSIS OF THE LYMPH GLANDS IN CHILDREN

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Tuberculous adenitis is a very common disease of childhood. It affects both the internal and external groups of glands. It is encountered by both the physician and surgeon during life, and is a frequent pathological lesion in the autopsy room in children dying from other causes. A very large number of the glandular enlargements designated up to comparatively recent date as scrofulous, were instances of glandular tuberculosis. It is predisposed to by an inherited tuberculous tendency, by poor hygienic surroundings, and by catarrhal conditions of the mucous membranes, and by that condition which has been described as lymphatism, where the general lymphatic enlargement offers favorable soil for tuberculous infection. It is very common in the colored race. The infection in the majority of instances reaches the gland through the lymphatic vessels, although it is probable that it is sometimes carried there through the blood channels. The pathological changes found consist in enlargement of the gland, which is at first pinkish-gray on section, almost translucent, soft, resembling an hypertrophied gland, but with miliary tubercles scattered through it, containing giant and epithelioid cells, and often numerous tubercle bacilli; in the later stages areas of cheesy degeneration develop, and finally liquefaction of a portion or of the entire gland supervenes. The tubercle bacilli, while now less conspicuous and often difficult to find, are still present. The capsule of the gland becomes adherent to the neighboring structures, and the tuberculous contents perforate and find their way to the surface of the body, or more rarely discharge into one of the natural cavities. A mixed infection of the abscess by pyogenic organisms may occur, and the phenomena of inflammation supervene. Instead of undergoing liquefaction, a caseating gland may undergo calcareous change; more often it becomes encapsulated, and fibroid changes follow with shrinkage of

the gland. In a considerable proportion of cases tuberculosis of other organs develops, notably the lungs and sometimes the bones or joints.

Infection of the lymph glands in children is often a primary one, especially in the cervical lymphatics. Certain groups of glands are more commonly affected than others. The cervical, mediastinal, mesenteric, and retro-peritoneal lymphatics are those most frequently attacked. The cervical glands in children are more frequently affected than those of any other external region. They constitute from 88 to 93 per cent. of the cases encountered surgically. The bronchial and mediastinal glands are the most frequently affected of the internal groups. It is to tuberculosis of the external glands that the attention of the surgeon is mainly directed. The surgical treatment of tabes mesenterica is still in its infancy, and while in some cases tuberculous lymphatic glands have been removed from the abdominal cavity, generally in the course of operations undertaken for other conditions, the routine surgical operation for this grave condition cannot yet be said to be upon a firm foundation. After the cervical glands, the axillary, cubital and inguinal rank as next in importance, those of the upper extremity being infected probably more often than those of the lower extremity.

Tuberculosis of the Cervical Glands.—As already stated, this outranks in frequency, and importance to the surgeon, infection of any other glandular area, and is probably the most common form of tuberculosis in childhood. It is more commonly met with in children than in adults. The favorite period of development is between two and ten years of age. It is rarely observed in infants under a year, although a few typical cases have been reported, one very recently by La Fétra. The neck is richly supplied with lymphatic glands, draining the extensive area of the head, mouth and pharynx. The glands are divided into two main groups,—the superficial or collecting, and the deep or terminal glands. The superficial glands form a sort of collar around the upper part of the neck, and may be subdivided into sub-occipital, mastoid, parotid and sub-parotid, submaxillary, submental and retro-pharyngeal. The deep or terminal glands from a chain beneath the sterno-cleido-mastoid muscle, which is flanked by several secondary chains. It is subdivided into

an external and internal group. The internal rests on the jugular vein or immediately adjacent to it; the external is placed posteriorly in relation to the insertions of the splenius, levator angulæ scapulæ and scalene muscles, and is usually continuous with the glands of the supraclavicular triangle. These glands are very frequently enlarged as a result of a variety of inflammatory and diseased conditions in the region drained by them, namely, the skin of the face, the scalp, the orbit, the naso-pharyngeal and buccal cavities and their contents, and the ear. The infection of tuberculosis in the majority of cases probably reaches the glands through the tonsils, faucial or pharyngeal, less frequently through or around carious teeth. The infection may take place through the tonsils with or without tuberculous change in these structures. Its entrance is favored, however, by disease of the tonsils, tuberculosis of which is not rare, and tubercle bacilli have also been demonstrated in decayed teeth and in apparently healthy mucous membrane.

The comparative frequency of tuberculosis of tonsillar and adenoid tissue has recently been emphasized and it is estimated that in 10 per cent. of the cases of enlarged tonsils and adenoids which come to operation, the tonsillar tissue removed shows the presence of tuberculosis. The recent observations of George B. Wood are of interest in a study of the routes of lymphatic infection. By the injection after death of the faucial and pharyngeal tonsils with coloring matter, he has worked out the lymphatic drainage of these structures. The faucial tonsil apparently drains into what he calls the tonsillar lymph node. This gland, the enlargement of which is a common clinical finding, is situated just beneath the anterior border of the sterno-mastoid muscle, where it is crossed by the posterior belly of the digastric, and is external and slightly anterior to the jugular vein. When enlarged it is easily palpable below and behind the angle of the jaw, and can be recognized by its freedom of motion posteriorly. The pharyngeal tonsil, he showed, drained to a gland beneath the posterior border of the upper portion of the sterno-cleido-mastoid muscle, one of the posterior group of the deep cervical glands. Infection from the teeth travels by way of the submaxillary glands. Now it is a significant fact that the upper glands of the cervical chain are the first to

undergo enlargement in the majority of cases, the infection traveling downward, although this is not always the case. While but one or two glands may be palpable, it will usually be found on operation that a number of others are pathologically enlarged and tuberculous.

The tuberculous infection may be a primary or secondary cause of the gland enlargement. Hyperplasia of the glands, as a result of acute or chronic inflammation, is of great frequency in childhood. Acute inflammatory adenitis is even more frequently encountered than tuberculous adenitis. Hyperplasia of tuberculous glands is also a common symptom. As to which is the primary infection it may be difficult to state. The history of an acute onset in cases of tuberculous adenitis is not infrequently elicited. So-called glandular fever, which in at least a certain proportion of cases is an infection due to the influenza organism, and adenitis the result of local infectious or inflammatory processes in the ear, the pharynx or the mouth, which does not undergo complete resolution, furnish a good soil for the secondary implantation of the tubercle bacillus. As already mentioned, the upper glands are those most frequently affected in the beginning, and while the enlargement may be confined to one or two glands, and while very often only one or two can be felt before operation, a careful dissection will usually demonstrate that other and deeper glands are enlarged and infected. Palpation is almost as unreliable a guide as to the exact extent of glandular involvement in the deep chain as it is in the axilla in cases of glandular metastasis in carcinoma of the breast. Several glands may be fused into one mass; or a long chain of glands of almost equal size may extend from the mastoid to the clavicle. Both sides of the neck are not infrequently involved, and in advanced cases the glands stand out in an almost collar-like mass. Fluctuation, deep-seated or superficial, results from caseation and liquefaction, when large glands are broken down, and also when the capsule is ruptured and a subcutaneous abscess forms. In some cases this breaking-down process occurs very rapidly, while in others the enlargement persists for months or years as an indolent, painless swelling. When the abscess becomes subcutaneous, the skin becomes thin, purple or red, and finally ulcerates, and from the small opening is discharged a thick, curdy pus, mixed with

cheesy particles. A sinus is formed, which usually persists for an indefinite time, its edges undermined, and after healing its place is taken by a ragged, irregular, puckered scar, at first livid, and later white in color. Where pyogenic infection occurs before rupture, the signs of inflammation are more marked. While some of the glands are softening and breaking down, others may still be in the early stage of enlargement. The infection may also travel downward into the axillary glands. Pulmonic lesions, especially apical consolidation, or even advanced phthisis, may co-exist, or tuberculosis of bones or joints be associated, and a considerable percentage of cases subsequently develop tuberculosis elsewhere.

Diagnosis.—Acute lymphadenitis is distinguished by the frequent presence of some exciting cause, either acute illness accompanied by glandular enlargement, or manifest trouble in the skin, scalp, teeth, or pharynx in the case of cervical glands, or of inflammatory conditions of the upper or lower extremity in the case of axillary and inguinal adenitis; also by the rapidity and marked inflammatory nature of the process, sometimes subsiding, more often suppurating. Chronic enlargement may be non-tuberculous, and in such cases it is difficult to separate it from tuberculous enlargement, especially when occurring between 2 and 10 years, when tuberculous adenitis is most common. If, after removal of all sources of possible infection and watching for a few weeks, it does not subside, it is better, in view of the great frequency of tuberculous adenitis in children, to treat it as such.

Both inflammatory and tuberculous adenitis may be associated with chronic affections of the naso-pharynx; the non-tuberculous is more apt to give rise to peri-glandular inflammation early which may later subside. It becomes adherent early, is not associated with tuberculosis elsewhere, and when suppurating lacks the cheesy tuberculous contents of the tuberculous gland. The tuberculin test may be useful or a small gland or a section of a larger one may be excised and examined.

Tuberculous adenitis may also require to be diagnosed from Hodgkin's disease, sarcoma, and syphilis. In Hodgkin's disease several groups of glands are commonly affected, the cervical, axillary, and inguinal being especially liable to involvement, and the absence of any tendency to softening or breaking down, in conjunc-

tion with the accompanying anæmia and cachexia, will be distinguishing points. The histological examination of a gland may be of value. From sarcoma of rapid growth the diagnosis may be difficult. The hardness of the tumor, the rapid increase in size, and an absence of tendency to softening may be features of diagnostic import, but incision may be necessary to furnish histological proof of the nature of the swelling. Glandular enlargement of a gross type is not common in children with inherited syphilis except where local lesions as rhagades and ulceration are present. Tuberculosis is not infrequently engrafted as a secondary infection in such children however. The absence of stigmata of inherited syphilis will be sufficient in most cases.

Treatment.—The treatment of tuberculosis of the lymph glands in children may be hygienic, medicinal, or operative. The surgery of tuberculosis of the internal lymph glands is still practically undeveloped. It is in these cases that those general measures useful in tuberculosis of any type are most applicable. The opinion of surgeons of the present day is practically unanimous in favor of the radical treatment of tuberculosis of what we have called the external glands. If it be granted that lymphatic infection may be primary, there would seem to be no good argument against its eradication by operation where such is feasible. Judgment must be exercised here as elsewhere in recommending operation. The presence of advanced tuberculous lesions in the lungs will usually be a contraindication to extensive operation. Here again the general hygienic and medicinal treatment of tuberculosis, the removal of the patient, where possible, to a favorable climate, and conservative measures such as evacuation and curetting of broken-down glands, will usually be all that can be expected to prove beneficial. The frequency of recurrence after partial or incomplete operations has strongly prejudiced the laity in some instances against operation, and discouraged a resort to the knife on the part of parents, and even sometimes of physicians. The introduction of X-ray therapy into the treatment of glandular tuberculosis is due in part to this feeling on the part of medical men, and in some instances of surgeons, as well as to the avidity with which that powerful, if uncertain, agent has been seized and used in a great variety of unrelated pathological conditions. Our own experience with the

X-rays in this condition has been limited, but from what we have seen in the practice of others, and from the published articles and observations of some of our colleagues we believe them to be uncertain and often disappointing, and are disposed to restrict their use to those cases in which operation is contraindicated on other grounds. Dr. Wm. J. Taylor, in an article on the effect of X-rays on glandular tissue, has called attention to the difficulty encountered in the removal of the lymph glands after such treatment. The operative difficulties in the way of adhesions are greatly increased thereby, and the prospects and the possibilities of thorough eradication, therefore, are lessened. Dr. Geo. C. Johnston, of Pittsburgh, stoutly maintains that when properly administered the X-rays should not produce such results. Nevertheless, the experience of capable surgeons has demonstrated that these results do take place. Moreover the recent work of D. L. Edsall has shown that the Rontgen therapy has a powerful and sometimes dangerous influence on metabolism, which is most threatening in the case of children, and would perhaps serve to act as a sufficient contraindication to its continued use at this age.

The results of operation constitute the strongest argument for early and radical interference. The after-history of these patients when treated expectantly shows a strong tendency to the development of tuberculosis elsewhere, and it is just in proportion to the thoroughness with which the primary foci in the glands are eradicated that permanent cure occurs. Dowd has grouped the statistics of Wohlgemuth, Haehl and Van Noorden. He finds that of 309 cases of tuberculous cervical lymphadenitis treated by operation and followed for several years, 65.4 per cent. were apparently cured, 18.4 per cent. were living, but with local or general tuberculosis, and 16.2 per cent. were dead of tuberculosis at the expiration of that time. Further studies on his part indicate a permanent cure in from 70 to 79 per cent. of cases after operation, and in only 24 per cent. of cases not operated upon. The statistics of Wohlgemuth in reference to the type of operation performed show a greater percentage of cure after radical than after palliative operations. The results are better in children than in adults. It is our own experience that in children of the better class, where good hygienic measures and surroundings can be secured, that the results of early

operation will be found better than these figures indicate, and we can with perfect honesty assure the parents of children brought under our care that in the great majority of cases complete recovery will take place. Inquiries as to the tuberculous or non-tuberculous nature of these lesions on the part of anxious parents are a constant indication to us of the significance to the laity of the word *tuberculous* in this connection, and we regard it as the duty of the surgeon to be frank and honest with the parents, that they may know the nature of the disease, the necessity for proper treatment, and for the institution and continuance of hygienic measures, and at the same time it is also his duty to instill confidence in the prospect of a final permanent cure.

Enlargement of lymphatic glands in any region should lead at once to examination for areas of infection in the region drained. When the enlargement occurs in the cervical region, the condition of the teeth and of the naso-pharynx should demand special investigation. Any lesions in these parts should be attended to, decayed teeth extracted or treated, catarrhal processes corrected, and what we regard as most important, enlarged tonsils and adenoid vegetations looked for. Immediate removal of these structures is often beneficial. Hyperplastic lymph nodes may disappear after such treatment, or acutely inflammed glands may suppurate and require incision. In early cases, if the glands remain in spite of such attention, it is justifiable to try the effects of tonic treatment, iron and codliver oil, and sea or mountain air for a month or two, where the social status of the patient permits, providing the glands are not rapidly increasing in size or breaking down. Counter-irritation by means of tincture of iodine or tincture of green soap, or the use of an ointment of ichthyol, mercury and belladonna may be practised. If, on the other hand, as is usually the case, the patient is brought to our attention when the enlargement of the glands has already persisted for a considerable time, either remaining unchanged, or continuing to grow, operation should be recommended, except in the presence of those conditions already mentioned as contraindications.

The history of the development of the operation for tuberculous adenitis is an interesting one. It represents the evolution from the older methods of simple incision and curettment, of the injection of

iodoform emulsion, preceded, perhaps, by aspiration of the gland contents, of ignipuncture by the Paquelin cautery, and the sudden swing of the pendulum of surgical practice to the most radical operations as practised through the incisions of Hartley, Senn and Dowd. Incision, curettment, aspiration, iodoform injection, and even ignipuncture are still practised, and may be found useful where single glands are breaking down, and where more radical treatment is contraindicated or declined. It is fair to say that in children very extensive incisions are oftentimes unnecessary, but in planning our operation we should bear in mind that even a careful preliminary palpation will often be deceptive as to the extent of involvement. We should be prepared, therefore, to undertake radical measures and to carry on extensive dissections. We have been deceived many times as to the extent of glandular involvement, and the difficulty of operation. It is unwise to undertake an operation in these cases unless one has ample assistance and every facility for prolonged dissection, and in the neck especially is this advisable.

Although radical operation is preferable as a routine treatment, judgment in this respect should be exercised. In children in good health and under good surroundings, in whom exploration shows only one or two, or a few, glands to be involved, a limited incision is adequate; a straight or curved vertical or oblique incision over the glands is often sufficient. For enlarged submaxillary glands an incision parallel to the border of the lower maxilla gives good cosmetic results. For enlargements under the sterno-cleido-mastoid muscle, a parallel or an S-shaped incision may be made. Large areas can also be exposed by an incision along the line of the sterno-cleido-mastoid muscle.

The introduction or the revival of the curved incision, parallel to the normal creases found in the neck, as a substitute for oblique or longitudinal incisions, is naturally of much interest. To Kocher is due the credit of calling attention to the lack of scarring after such incisions. The tendency of oblique or longitudinal scars to stretch and become hypertrophied is responsible for the adoption by many surgeons of the transverse incision. We have long been in the habit of closing the deeper portion of wounds in this location by buried suture, and Mayo has recently pointed out that such suture of the fascia prevents subsequent widening of the scar.

While the cosmetic result of the curved incision is at present undisputed, there can be no question that the exposure of the region to be dissected is much more limited, and the operative difficulties thereby considerably increased. We have frequently practised, and are investigating this method, but we are not sure that it will continue to grow in favor. Multiple incisions are often necessary, and where the internal jugular vein is adherent to the chain of glands for a considerable distance, as is commonly the case, the dissection is carried out from one incision to the next with difficulty. Dowd makes one incision parallel to or below the angle of the jaw, another some distance lower down where necessary, and prolongs the lower incision vertically upward and backward posteriorly to the hair line. The longitudinal portion of the scar is therefore rendered less conspicuous. Eisendrath rejects the transverse incision on account of the lack of sufficient exposure. It will probably be some little time before the limitations of usefulness of this transverse incision are definitely established. The three structures most in danger, in operations on glands in the cervical region, are the internal jugular vein with its branches, the spinal accessory nerve, and that branch of the facial nerve which supplies the depressor labii inferiorus muscle. This nerve, as Dowd points out, enters the neck at about the anterior border of the sterno-mastoid muscle, runs forward about a half inch below the border of the jaw, which it crosses in an upward and forward direction with the facial artery. It may be, and has been frequently divided in this situation. Paralysis in its distribution has occurred several times in our own practice. The paralysis is said to be usually temporary, occasionally persistent. It is avoided by making the incision where necessary in this region below the usual course of the nerve, and by avoiding dissection between the platysma and the deep cervical fascia (Dowd).

In dissecting out the glands, they should be removed in one chain where possible, and should not be ruptured if this can be prevented, as tuberculous infection of the wound easily occurs, and interferes with healing, as well as favors recurrence.

The superficial cervical nerve, crossing the neck at the level of the thyroid cartilage, should be avoided. Great care should be exercised in dissecting in the deeper regions of the neck. All blood-

vessels should be clamped as soon as divided, the wound kept free of blood, and the dissection made as dry as possible. Care should be made in making traction upon the glands, as they are very commonly adherent to the sheath of the vessels and to the internal jugular vein, which can under such circumstances easily be nicked or widely opened. The Allis dissector we have found a most useful instrument for this work. Wounds of the veins are frequently produced, and should at once be sutured, or a lateral ligature applied, or if these measures are impossible, it must be ligated. Short wide veins running directly into the vein from the glands bleed furiously; although the hæmorrhage is profuse and alarming, serious results seldom follow this accident. The spinal accessory, recurrent laryngeal, phrenic and pneumogastric nerves, and sympathetic cord, must be watched for. Injury of the spinal accessory results sometimes in drooping of the shoulder on the same side, although usually its division is not followed by serious consequences. We do not think division of the sterno-mastoid muscle is often needed, cases may be met where it would be indicated. The thoracic duct may be opened; if this happens, and the accident is recognized, attempts at suture should be made, otherwise compression by gauze will usually result in closure of the lymphatic fistula. Exceptionally, secondary operation may be necessary to close it. Important structures may suffer, even in the hands of the best operators, and some of these operations necessitate the most difficult of dissections. In spite of this, however, the mortality is low.

When single glands are broken down, curettment, and removal of the gland and its capsule is all that is advisable. Sinuses should be explored, incised and curetted, when partially broken-down glands will often be found as a cause of their persistence, and these should be thoroughly removed. Overhanging edges of unhealthy skin should be trimmed away and their edges neatly sutured. Drainage by gauze or rubber tissue will usually be found necessary in extensive operations, as well as in infected cases, as it carries away any oozing, and if soon removed does not interfere with primary healing. In spite of great care wounds will sometimes open up and become unhealthy as a result of tubercular or pyogenic infection liberated in dissection, and these should be treated by iodoform gauze packing and encouragement of granulation. After extensive

operations it is well to keep the child's head fixed by sand-bags, or a pasteboard collar, to aid healing, and the subsequent treatment should include all the hygienic measures previously recommended.

Where both sides of the neck are involved the surgeon is sometimes perplexed in determining how much it is justifiable to attempt at one operation. In cases of limited enlargement both sides may be operated upon at the same sitting. Where prolonged work is necessary we believe it is safer, in operating upon children, to attack the worst side first, and leave the opposite chain until a later date.

Attention has already been called several times to the frequent presence of enlarged tonsils in children with cervical adenitis. A systematic examination for these conditions should always be made before operation. The children are often mouth-breathers and can be seen to be the victims of adenoids by even the casual examiner. When should these structures be removed in cases where operation on the lymph glands is indicated? We have always hesitated to recommend the combined operation of removal of cervical glands and adenoids. The unexpected prolongation of operation in cases seemingly simple, the evident necessity for prolonged dissection in many cases, and the fear of added shock and hæmorrhage are potent factors in deciding against removal of the glands and the tonsils and adenoids at the same sitting. Our practice is first to operate upon the glands. At the expiration of a week, or about the time the child is ready to leave the hospital, we have the laryngologist perform the second operation upon the tonsils and adenoids in the usual manner. This does not delay the discharge of the patient more than a day or two at the utmost, and we have seen no disadvantage resulting from the second operation and the anæsthesia necessary thereto. In nervous children it affords an excellent opportunity for the removal of stitches. We believe that the radical operation on the tonsils and adenoids is a potent factor in preventing recurrence of glandular enlargement in the neck.

Gynecology

THE TREATMENT OF DYSMENORRHŒA BY FORCIBLE DILATATION OF THE CERVICAL CANAL AND APPLICATION OF THE WYLIE DRAIN

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The form of dysmenorrhœa, of severely painful menstruation, to which I wish to call your attention and recommend a special surgical treatment is that occurring in young girls and young married women and characterized by violent intermittent or constant sharp shooting pain situated in the centre of the lower abdomen and extending down the thighs. In the later years of the disease or after marriage the pain increases in severity and duration and extends to the whole pelvis and back. The pain has its onset several hours or just before the appearance of the hæmorrhagic flow or during the first one or two days of the flow. The patient is incapacitated for any occupation or duty and is as a rule confined to bed. The cause of such dysmenorrhœa is a pathological anteflexion of the uterus of one of the anatomical varieties described in text-books on Gynecology, a malformation of the shape of the organ, and in the sense of modern investigation also due to a failure of development of the organ as a whole, of its muscularis and often of the entire genital tract. Physical examination determines the presence of a small organ often infantile in shape, anteflexed to a more or less extreme degree, frequently with imperfect invagination of the anterior lip of the cervix into the vagina, and rarely, as an indication of imperfect development, having the congenital split of the cervix described by Penrose.

The pain is in part due to obstruction of the cervical canal at the point of flexion, at the internal os, and in part to an inefficiency

of the uterine muscularis, because of its imperfect development, to carry out its function in the act of menstruation. One or the other of these factors predominates in the individual case.

This form of dysmenorrhœa, of single women or sterile married women, having the definitely characteristic symptoms and physical changes described, represents at least 98 per cent. of the cases which have come under our charge during the last 14 years. We would have it understood that in this consideration of the subject we do not refer to the rare cases of ovarian dysmenorrhœa accompanied by atrophic changes in the ovaries, to dysmenorrhœa dependent upon intraabdominal pelvic inflammation or to the painful menstruation incident to profound neurasthenia.

The diagnosis of what I shall here call, for the sake of convenience, the dysmenorrhœa of pathological anteflexion, is determined by the characteristic position of the pain, the time of occurrence of pain and the physical examination.

The treatment of the dysmenorrhœa of pathological anteflexion by the use of medicinal remedies, it has long been determined, is without the least value. The only drug giving relief, and which unfortunately the practitioner is often driven to administer each month as a last resort, is Morphia.

The surgical treatment whether by slow dilatation, forcible dilatation or application of the operation of division of the posterior lip of the cervix by Dudley, while giving relief in some instances, more often fails or the symptoms recur within a period of two or three months.

If the cause of this common form of dysmenorrhœa be a pathological anteflexion of the uterus with obstruction of the cervical canal and a condition of incomplete development of the uterine body, active through an inefficiency of its muscularis, then the indication for treatment should be directed to the correction of the cause, namely the relief of the obstruction and development of the uterine muscularis. It is further to be recognized that the more completely these indications are met the more satisfactory and permanent will be the result.

For a number of years it was our custom to practice thorough and prolonged forcible dilation of the cervical canal as described by Goodell. In the carrying out of this treatment it was noticed

that where the best results were gained the uterus enlarged, the menstrual flow became more profuse and there were positive indications of a further development of the external genitals and breasts. The state of well being and general health of the woman was improved.

Acting upon this suggestion and learning of the markedly beneficial results in this direction published by Carstens of Detroit after the office introduction of the Chambers stem pessary, we determined upon and began about three years ago to carry out the following surgical treatment.

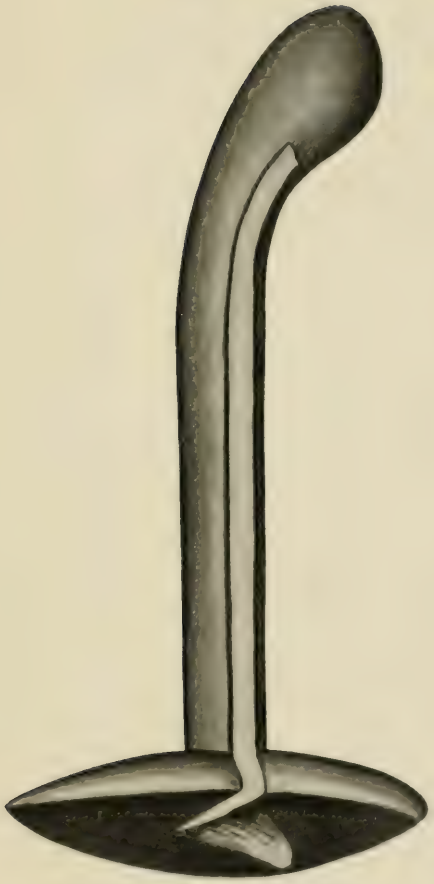
The patient is prepared as for the practice of any surgical operation upon the vaginal tract, the vagina and external genitalia being thoroughly cleansed and antisepticised. The woman is etherized and placed in the dorso-sacral position. The cervix is exposed through the Sims speculum and the anterior lip seized with a double tenaculum. The small Goodell dilator is introduced into the cervical canal and then the larger instrument. The operator should be sure that the dilating blades pass beyond the internal os, that they be introduced up to the flange of this part of the instrument. Dilatation is then begun and slowly carried to the point where the register at the handles of the instrument shows that the canal has been dilated to one and a half inches. The dilatation should be very slowly and carefully carried out, requiring at least fifteen minutes, so as to simply stretch and in no way tear or injure the mucosa or muscle. The instrument is then removed, again introduced, and for the second time the dilatation is carried to the same point. The object of the second introduction of the instrument is to grasp and stretch the muscle in another position. The instrument is then allowed to remain in position for fully fifteen minutes, the fifteen minutes of time being taken by the etherizer.

If the uterus is very small, the cervical canal should not be dilated to a greater extent than one and a fourth inches.

We believe the more painstaking and thorough this procedure of dilatation is performed and the greater amount of time is consumed in the step, the more permanent will be the patency of the canal. With Goodell we agree that the benefit to be gained is dependent upon these factors and the experience of the operator.

The instrument is then withdrawn, the vagina and cervical canal

Fig. 1.



The Wylie Drain.

washed out with a 1–2000 bichloride of mercury solution. A hard rubber Wylie drain is then introduced into the uterine cavity, the size of the drain being such as to require a little force to have the bulbous portion pass the internal os. Before introduction the instrument is sterilized by boiling and while warm is bent forward into the shape of the canal of the normally anteflexed uterus, the drainage groove being on the right lateral surface. A light gauze pack is then placed in the vagina, completing the operation. The patient is required to remain in bed in the recumbent position for two weeks. The Wylie drain is left in position for three or six months and where necessary a year. During the convalescence after operation and the time the instrument is worn a daily boric acid vaginal douche is administered.

The Wylie drain is an instrument having somewhat the shape and form of the old stem pessary, but differing in that the uterine end is somewhat bulbous in shape, enlarged for a distance of a half inch, and along its lateral surface there is a deep groove. The bulbous portion has the purpose of forming a good sized body upon or against which the uterus contracts. Likewise it is of advantage in preventing the expulsion of the instrument. The lateral groove provides for drainage, permitting the discharge of the menstrual blood (Fig. 1).

The object of the wearing of the Wylie drain is the development of the uterine muscularis and thus the entire uterus. The principle of action being the same as where there exists in the uterine cavity a polypus or foreign body. As has been observed by every practitioner of medicine, the uterine muscle contracts upon this body in its attempts to expel it, and necessarily the muscle is exercised, develops, the body of the uterus is enlarged, and to a considerable extent, for the same reason, the cervical canal is increased in calibre.

The development of the uterus thus affected by the use of the Wylie drain remains to a greater or less extent after the instrument is withdrawn, removing the cause and thus curing the dysmenorrhœa. It is probable too that the uterus once stimulated to development continues in its development to perhaps normal.

The length of time which the instrument is to be worn is determined by the degree of its effect, the amount of development being

estimated by the relief of pain at menstruation. If after a few months the pain returns the instrument is again introduced under antiseptic precautions and worn for a greater period.

Since the fall of 1904 we have carried out this treatment in 46 women, 28 of whom were single and 17 married. We have recently sent communications to these patients asking for a statement regarding the influence of the operation and have replies from 41, 26 of the single women and 15 of the married women.

Twenty-two of the single women state that they have been entirely relieved of the menstrual pain, 2 are benefited but still have considerable pain and in 2 the dysmenorrhœa remains unchanged. Twelve of the married women write that the relief has been complete and 3 have received no benefit. In 3 of the cases where no benefit followed the pain was absent for 3, 4 and 6 months and then returned with its old severity. Two have amenorrhœa as before treatment. In practically all of those relieved the menstrual period has become more regular and much more profuse.

Therefore 85 per cent. of the single women and 80 per cent. of the married women have evidently been cured of their dysmenorrhœa through this treatment.

Of the 15 married women 5 have since operation become pregnant, one miscarrying at the 4th month, another at the 5th month and the others going to term. The previous history of the married women becoming pregnant determines that 2 were married three years, 1 four and the other 2 five years before operation and the marriage would thus be considered a sterile one. Since one-third of the married women became pregnant after operation it is a fair conclusion that the treatment is a valuable cure for sterility.

That 80 per cent. of all these women operated upon and heard from have been completely relieved proved, at least in our experience, that the treatment is far more beneficial than any yet devised.

From a study of these cases and after an experience of three years it is our opinion that the result of the treatment would have in many instances been improved had we allowed the instrument to remain in position a greater length of time, it often being removed at the end of two weeks. This particularly in those instances where there was a marked degree of undevelopment and in those where a failure followed. In ten of the cases cured the operation of for-

cible dilatation had previously been performed without benefit by myself or other operators.

The contraindication to the operation and Wylie drain is the presence of intraabdominal pelvic inflammation of any character, and the surgeon should be doubly assured that no such disease exists before proceeding to the treatment.

I would again emphasize that the most rigid aseptic and antiseptic technique is to be practiced both in the carrying out of the forcible dilatation and introduction of the Wylie drain. The instrument should never be introduced as an office treatment, either primarily or secondarily.

The introduction into the uterine cavity and wearing of a rubber instrument, I know, is a procedure subjected to criticism, for every gynæcologist of experience has been taught or knows from experience that the old stem pessary thus introduced often became infected resulting in pelvic inflammation and not infrequently in general peritonitis and death. For this reason our early cases were kept under observation with much concern. Not the slightest indication of such complication and result has followed in any case of the 46 cases operated upon, and we are therefore able to assert that the treatment is absolutely safe if carried out under the surgical technique described. No man not trained in surgery or who cannot provide the proper hospital surroundings should attempt the treatment.

THE PATHOGENESIS OF SYNCYTIOMA MALIGNUM *

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THE prevailing unsettled and unsatisfactory state of scientific opinion concerning the neoplasm commonly known as deciduoma malignum constitutes the principal *raison d'etre* of this contribution.

In 1877 Chairi discovered and imperfectly described (*Wiener Med. Jahrb.*) what appeared to be an hitherto unrecognized variety of malignant disease involving the corpus uteri, which, in three instances under his observation, had developed in young primiparæ soon after delivery and terminated fatally within six months. Since that time there has been continuous discussion, speculation and controversy concerning the morphology, pathogenesis, pathological histology and classification of the neoplasm mentioned in the superscription to this paper.

Investigators in different parts of the world have suggested various designations to represent the affection, each attempting to maintain that the name proposed possessed advantages and should be given preference over former appellations in that it conveyed a more or less adequate intimation of the pathogenesis and pathological histology,—*e.g.*, (1) deciduoma malignum, (2) decidual-cell sarcoma, (3) sarcoma chorio-cellulare, (4) chorio-epithelioma, (5) sarcoma-deciduo-cellulare, (6) carcinoma syncytiale, or syncytial carcinoma, (7) chorio-epithelioma malignum, (8) syncytial sarcoma, (9) chorion epithelioma, (10) malignant placentoma, (11) syncytioma malignum.

It is believed the last mentioned designation is more appropriate than any hitherto suggested, in that it comes nearer expressing a definite intimation of the pathogenesis and pathological histology, particularly since it is contended that the neoplasm is composed purely of syncytial masses.

Chairi was promptly followed by Tibaldi, Guttenplan and others

* Incorporating resumé of a paper published in the *Medical Age*, 1906

who also recorded instances of a peculiar malignant disease of the uterus developing subsequent to parturition, in all of which the patients perished within a few months; but until the appearance of Sänger's more elaborate description (*Centralblatt für Gynakologie*, 1889) embracing the histories of three cases observed by himself and reported to the Leipzig Obstetrical Society the previous year, with a resumé of all others recorded up to that time, outlining what he believed to be the probable pathology and suggesting the name deciduoma malignum, little real scientific interest was manifested in the so-called newly discovered surgical affection. However, it cannot be reasonably claimed that the subject has been neglected since that date, as there have been in progress many painstaking investigations, and, as a result, much valuable information has been contributed to the scientific press within recent years.

Pfeiffer (*Prager Med. Wochen.*, 1890) discussed the question of malignant hydatid mole, Sänger again reviewed the entire subject in 1893, and during 1894–5–6 numerous important additions were made to the literature, notably by Gottschalk, Schmorl, Ruge, Pestalozzi, Marchand, Bacon, Frankel, Williams, Paviot, Lohlein, Kussman, Hartman, Jeannel, Klein, Toupet, Novi-Josserand, Kottnitz, Lebensbaum, Apfelstedt, Eden, Menge, Pesenelli, Superno, Kuppenheim, Tonnen, Schauta, Aschoff, Lounberg, Mannheimer, Morrison, Spencer, Beach, Cazin, Neumann, Monad, Kastron, and many others.

Marchand in 1895 collected a total of 28 cases thus far recorded. Of these 24 perished from sepsis, peritonitis, hæmorrhage and metastases. Dorland in 1897 (*University Medical Magazine*) mentions 52 instances of the neoplasm under consideration, with mortality of 73 per cent. Williams (*American Journal of Obstetrics*, 1898) found record of only 45 well-authenticated examples. None of these occurred in primiparæ, and each developed before the menopause. In seven instances the women were under twenty-five, and the larger percentage were less than thirty years of age. In 45 per cent. the neoplasm developed subsequent to hydatiform mole.

Durante (*Rev. Med. de la Suisse Romande*) published an exhaustive review of the literature in 1899, as was also done by Marchesi, of Palermo, in 1900, the latter recording (*Annals di*

Ostet.) what was said to be the first instance of syncytioma malignum ever observed on the Island of Sicily.

Ladinski in 1902 (*American Journal of Obstetrics*) was able to gather from the literature of the world 132 authentic instances of this neoplasm, many of which (especially the earlier cases) he claims were but casually observed, at least imperfectly recorded. Of the total number ten were reported in America, nine in England, the majority of the others in Germany. In 128 cases where pregnancy was mentioned, 51 followed hydatiform mole; abortion 42; labor at term 28; premature labor 4; tubal pregnancy 3. Thus it will be noted that in 40 per cent. of cases the neoplasm developed subsequent to mole pregnancy.

While there is great divergence of opinion among pathologists concerning the probable relationship between hydatiform mole and syncytioma malignum, the majority of observers agree with Marchand (*Monatschrift für Geb. und Gynakologie,* 1895), who was among the first to show that hydatiform mole is not a true myxoma of the chorionic villi (as was claimed by Virchow, *et al.*) but is due to increased growth of the syncytium and a proliferation of Langhans' cells, which produce mechanical dropsy of the stroma of the chorionic villi. However, whether the mole is actually the result of pathological changes in the ovum, or in the corpus uteri, cannot at present be determined with any degree of accuracy.

The designation deciduoma malignum primarily suggested by Sänger was based upon the hypothesis that the neoplasm originated from the decidual cells, *i.e.,* that it was a malignant degeneration of the decidua serotina, and since this structure is probably formed from hyperplastic connective-tissue stroma of the endometrium, the name seemed appropriate. Subsequently, however, Sänger (*Archiv. für Gynakologie,* 1893) submitted a study of additional cases and suggested another designation which more accurately expressed his later interpretation of the pathology as revealed by further investigation, viz.: sarcoma deciduo-cellulare, believing that the neoplasm was a sarcoma originating from the products of conception. The correctness of this view was seriously questioned by Marchand and others whose investigations indicated that the cells hitherto supposed to be decidual in character were really syncytial (maternal epithelium?) or fœtal ectodermic (Langhans' ?) cells which had

undergone malignant proliferation. In this connection, however, it must be admitted that the question whether the syncytial cells are of maternal or fœtal origin has never been satisfactorily demonstrated.

Gottschalk (*Archiv. für Gynakologie,* 1894) proposed as a more appropriate designation sarcoma chorio-cellulare, under the impression that the neoplasm owed its origin to malignant degeneration of the stroma of the chorionic villi.

The majority of observers having accepted the views of Marchand, *i.e.,* that the structure of this neoplasm is composed of epithelial layers of the chorionic villi, persistent efforts have been made to determine the true genesis of these layers. Langhans originally held that the outer layer was derived from the fœtal ectoblast, the inner layer being a derivative of the mesoderm, but was later induced to believe the outer layer was of maternal and not fœtal origin because of the finding of cilia on the outer border of the protoplasmic masses by himself, Klebs, and others. There are three more or less reasonable theories in regard to the derivation of the two layers referred to, which are interpolated for reference, *viz.:*

(1) Kastcheno's theory, that the two layers are of fœtal epithelial origin, that the syncytium is primary and from it the Langhans' cells are formed.

(2) The theory of Hubrecht and Duval, who from studies of early placentæ in animals conclude that the cell layer is first and that the syncytium is derived from it.

(3) The theory of Strahl, that the Langhans' cells are derived from the fœtal ectoderm, and that the syncytium comes from the uterine epithelium. (From Pierce, *American Journal of Obstetrics,* 1902.)

As already indicated the views of Marchand concerning the pathology of syncytioma malignum are at present accorded the greatest consideration, and the investigations of Langhans and others on the histology of the chorion, especially the work of Peters and his associates on the early stages of development of the ovum (during its period of implantation), have given the ideas of Marchand ample support. According to his latest views, the neoplasm is composed entirely of tissue arising from the fœtal ectoblast, and not of the maternal mesoblast as claimed by other observers, that the fœtal

ectoblast (or trophoblast) gives rise in the developed chorion to a layer of what are known as Langhans' cells, that these lie upon the stroma of the villus and probably represent the most highly vitalized tissue of the chorion, and from them by the process of differentiation the outer syncytial covering of the villus is derived.[1]

In an attempt definitely to settle the controversy among those engaged in investigating this subject, the London Obstetrical Society in 1896 appointed a commission to determine if possible the pathology of the neoplasm under consideration, and to indicate its proper classification. The verdict was that the growth was nothing more nor less than a sarcoma of the uterus, and it was practically denied that there was necessarily any relationship between it and pregnancy! That the findings and report of this learned commission were distinctly erroneous, there is an enormous mass of indubitable accumulated evidence to prove; and it is believed the English school now practically agree with the ideas of their German and American cousins in reference to the pathological histology and classification of syncytioma malignum, by whatever name it may be designated, *i.e.*, (*a*) that it is neither sarcoma nor a carcinoma, (*b*) that it arises primarily in the syncytium, and (*c*) that it is entitled to the distinction of being classified as a neoplasm, *sui generis*.

Veit in 1901 attempted to account for the presence of syncytioma malignum on the hypothesis of its " springing from deported fragments of chorionic tissue escaping into the maternal blood vessels." This somewhat ingenious theory, like all other similar fanciful departures from the strictly scientific in medicine, found ardent advocates; but the proposition appears ridiculous when it is remembered that such " deported fragments " are usually promptly absorbed in the maternal organism in normal as well as in pathological conditions, consequently the theory is held as unproven, or at best an insufficient explanation, so far as the primary neoplasm is concerned. In justice to its author, however, it must be admitted that since it seems to have been clearly demonstrated the malignant

[1] In this connection it must be remembered that the so-called cells of Langhans are almost invariably found present in syncytioma malignum, according to the statements of most observers. They are called by some the " invaders; " but in both the primary and metastatic growths syncytial derivatives are found in abundance. H.

process under consideration is disseminated by the blood current, the metastatic developments might technically be the result of "deported fragments escaping into the maternal blood vessels."

Some of the most careful observers are of the opinion that what appear to be individual (giant) cells in various parts of the neoplasm (*i.e.*, the cells containing several nuclei), are in reality only cross-sections of masses of syncytial protoplasm containing free nuclei. If this view be correct, then the most reasonable inference is that all varieties of the malignant neoplastic cells present may be referred to a syncytial origin, and after careful scrutiny of available accumulated data the writers believe this represents the truth as nearly as it can be ascertained from information thus far adduced.

According to Williams (loc. cit.) the most prominent histological features of the neoplasm are:

(1) A fibrous reticulum resembling organized blood, in the meshes of which are large spaces containing blood and fibrin, but no glands, blood vessels, or lymphatics.

(2) Bars, bands, and islands of syncytial and Langhans' cells between the blood spaces, and in masses throughout the growth.

(3) Vacuoles in the syncytial protoplasm, and in some cases distinct chorionic villi.

(4) A small round-cell infiltration, in the fibrous reticulum and in the homogenous protoplasm, is also conspicuously present.

Kelly and Teacher (*Journal of Pathology and Bacteriology*) suggest that in view of the epithelial origin of the neoplasm, the manner in which it infiltrates the adjacent structures, and the secondary involvement of the lymphatic glands connected with the primary growth, it appears to have much more affinity with carcinoma than with sarcoma; though the manner in which it spreads by the blood stream directly and at an early period is more characteristic of sarcoma. On the whole they agree with Marchand and others that it should be regarded as a neoplasm, *sui generis*.

There are, it would appear, five more or less distinct theories to account for the origin of syncytioma malignum, each based upon but slightly different conceptions of the pathological histology, viz.:

(1) The theories of Sänger that the neoplasm is either the result (*a*) of malignant changes in the decidual cells, or (*b*) that it is a sarcoma developing from the products of conception.

(2) The theory of English observers that it is a sarcoma of connective-tissue origin the elements of which exist in the uterus independently of pregnancy.

(3) The theory of Chalezky that death of the embryo is the cause, the chorion in consequence receiving nutrition intended for the fœtus.

(4) The theory of Marchand that it is due to a malignant proliferation of the epithelial layers of the chorionic villi.

(5) The view held by a large number of others that the neoplasm arises in the syncytium and is composed of purely syncytial masses, that it is not related to either sarcoma or carcinoma, that it is a neoplasm, *sui generis*.

It seems to have been definitely shown by conscientious and competent investigators that the first, second and third theories are based upon distinctly erroneous premises, and likewise that the fourth is only partially true. Moreover, that the fifth differs in no essential respect from the fourth except its advocates do not concur in the belief that the neoplasm arises in the epithelial layers of the chorionic villi, or that it is *per se* an epithelioma, but insist that it is composed entirely of syncytial masses.

The syncytium is a structure (probably maternal) lying between the decidua and chorionic villi over the layer of Langhans' cells, and the neoplasm owes its origin to this structure, not to Langhans' cells, or the epithelial covering of the chorionic villi. It must not be forgotten, however, in this connection, that as the origin of the syncytium, and likewise Langhans' cell layer, remains unsettled it cannot be definitely stated whether syncytioma malignum originates in fœtal or in maternal structures,—it may be in both.

It is unfortunate that there should exist so much confusion and divergence of opinion concerning the pathology and classification of this neoplasm, since the resultant controversy and discord only tend to impede scientific progress toward adequate enlightenment. Even one of the latest medical lexicographers defines deciduoma thus: An intra-uterine neoplasm formed mainly of connective-tissue elements, and arising, apparently, from the remains of the decidua of a pregnancy which has been terminated by an abortion! This is certainly far from the truth, as in only an inconsiderable number of instances has the neoplasm developed subsequent to abor-

tion, the majority occurring after the expulsion of hydatiform moles. Pregnancy is an absolute precursory condition, according to most authors, and has preceded the neoplasm in all recorded instances (Ladinski) with the exception of one (Paviot), and the history of that case is exceedingly questionable from the standpoint of reliability.[2]

Ladinski (loc. cit.) remarks that there is on record no instance where syncytioma malignum developed outside the parturient age, but such a case is recorded by McCann (*Journal of Obstetrics and Gynecology,* 1903), a brief abstract of which may not be uninteresting in this connection on account of its rarity: The patient, aged fifty-three, mother of ten children, sought relief from severe uterine hæmorrhage which had occurred every few days for four months. Menstruation had ceased eighteen months previously. Examination revealed uterus uniformly enlarged, soft, freely movable. Introduction of sound caused markedly increased hæmorrhage. Vaginal hysterectomy two days later, death in six days. Investigation showed uterus filled with blood clot, evidence of new growth between clot and uterine wall. The neoplasm was composed of multinucleated masses of protoplasm and loosely reticulated tissue containing in its meshwork cells with deeply staining nuclei; remainder of section fibrin and blood clot. It was regarded as a typical example of syncytioma malignum.

The average age at which the neoplasm developed (Ladinski) in 124 cases was 32 years; average number of pregnancies in 90 cases 4.2; average time when the neoplasm appeared after mole pregnancy in 44 cases eight weeks; after abortion in 40 cases seven weeks; after labor at term in 29 cases five weeks. One of its principal characteristics is a marked tendency to early metastasis, the secondary developments frequently exceeding the primary neoplasm in extent of their growth. Metastatic deposits consist of elements similar to those composing the primary tumor, and have been found (Ladinski) in the following organs in the order of their frequency:

[2] This statement was evidently made by Ladinski in the belief that the neoplasm was unknown to occur in other parts or organs of the body than the uterus, a position which has since been proven incorrect according to the evidence cited by other competent investigators, vide cases recorded by Fisch, Hicks, Walthard, *et al.* H.

Lungs 47 cases; vagina 40; liver 13; spleen 13; kidneys 13; ovaries 10; intestine 8; brain 7; broad ligament 5; pleura 4; mesenteric glands 3; pancreas 2; heart 1; stomach 1; pelvic lymphatic glands 1. And because of its rapid development, its marked tendency to early metastasis and recurrence, it is regarded as the most fatal of all malignant neoplasms. In 124 cases the records show 73 deaths, or a mortality of 59 per cent., the cause of death being: metastases 45, hæmorrhage and exhaustion 20, perforation of the uterus 4, operative shock and sepsis 4. Of 66 patients promptly subjected to radical surgical intervention 50 are said to have recovered.

Of Williams' 45 cases, 20 were operated upon; 3 perished as an immediate result of the operation; 3 others succumbed within six months from metastases; the other 14 remained free from symptoms. All patients the subjects of this neoplasm promptly perish unless submitted to early radical operation, and according to Eiermann's statistics death occurs in most instances within six months whether the aid of surgery be invoked or not.

The neoplasm is ordinarily of placental consistence, *i.e.*, soft, friable, easily broken down and removed by the finger or curette; the uterine wall is early invaded by the malignant process, becoming softened and readily perforated. There is usually persistent recurrent metrorrhagia often resulting in profound even mortal anæmia.

The most important clinical features observed are:

(1) History of parturition, abortion, extrusion of hydatiform mole, or retention of placental fragments.

(2) Irregular uterine hæmorrhage not amenable to treatment, even recurring despite repeated curettment, presence of more or less constant sanguineous discharge.

(3) Enlarged hyperplastic uterus and cervix, with persistently patulous os.

(4) Localized pelvic pain may or may not be present.

(5) Profound, rapidly increasing anæmia, loss of flesh, diminution of strength, cachexia.

(6) Evidence of metastatic deposits, particularly in the vagina and lungs, the latter inducing cough and bloody expectoration.

(7) A characteristic nodule may in some instances be detected in the corpus uteri even during the early stages.

Inasmuch as in 40 to 50 per cent. of cases syncytioma malignum develops subsequent to mole pregnancy, it would be interesting to determine, were it possible to do so, (*a*) why such gestations are apparently more likely to be followed by development of this neoplasm, and (*b*) why in certain instances malignancy supervenes, whereas in others the mole is extruded promptly and is followed by no abnormal phenomena. However, owing to the present unsettled and unsatisfactory state of knowledge concerning the entire subject, it is manifestly impossible even to suggest a reasonable explanation; in fact, little appears to be positively known in regard to the origin and development of either hydatiform or fleshy moles, as is evidenced by the following excerpt from a recognized authoritative source: Extravasation of blood between the maternal and fœtal structures of the fecundated ovum, or into the tissues of the latter, appears to be the active agent in the production of the fleshy mole; though it is difficult to determine the agencies whereby this condition is brought about. With respect to hydatiform mole the same writer states that all authorities agree the vesicles grow from the chorionic villi. There is no new formation, but excessive and erratic development. . . . Whether the change is the cause or consequence of the death of the embryo is unsettled. . . . The vesicular mole belongs to the class of pathological products known as myxomata!

Breus in 1892 described a peculiar degeneration of "retained abortive ova" to which he gave the name "tuberous sub-chorial hematoma," since which time many investigators have been interested in the histology and etiology of these moles. Only twice, it is said, has a mole been found which seemed to combine the characteristics of a tuberous hematom with those of an hydatiform mole, once by Micholitzer, and once by Reisch. The fœtus died approximately during the fourth month of pregnancy, and the dead ovum was retained for about eight months. The expelled mole was about the size of a fist. At the place of its attachment to the uterus chorionic villi could be seen transformed into the characteristic small vesicles. The interior of the amniotic cavity offered the typical appearance of a tuberous hematom mole. No trace of either fœtus or umbilical cord was left (Reisch).

In commenting upon the statistics cited by Neumann, Butz (quoted by Pierce, loc. cit.) observes:

(1) Malignancy does not lie in the inward proliferation of the syncytial elements as claimed by Neumann.

(2) The peculiarity of the case described by him was in showing small villous processes and a scarcity of mole vesicles.

(3) Where the mole is only partially extruded spontaneously, the remainder being removed in pieces by curette or finger, the liability to malignancy is greater than where the mole is expelled entire.

(4) Specimens from the curettment in his case showed a proliferation of fœtal cells into the depths of the mucous membrane no further than is observed after normal birth, but in much larger quantity.

(5) Malignancy lies in disease of the uterus, not in the mole itself.

Horrocks (London Obstetrical Society) thought there were two kinds of malignant growths associated with pregnancy, *viz.:* one of decidual (*i.e.,* maternal) origin, which is sarcomatous; the other a chorion epithelioma (of fœtal origin) which is carcinomatous. Haultain considered the finding of syncytial masses in uterine scrapings, especially just after expulsion of a mole, no justification for such radical treatment as hysterectomy, since fragments retained might show no tendency to malignancy and simple curetting might be quite sufficient. Neoplasms presenting exactly similar histological appearances have developed in females who had never been pregnant, even in males, and in various parts of the body.

Frankel (London Obstetrical Society) suggests that as hydatiform moles have been complicated with bilateral ovarian cystoma in certain instances, this fact would tend to prove the ovigenous origin of these moles! While, as stated, such phenomena may have been repeatedly observed, his suggestion certainly proves nothing, and is only mentioned as a point of interest *en passant.*

Metcalf and Safford (*American Journal of Obstetrics,* 1904) believe syncytioma malignum belongs to a distinct class of neoplasms, apparently differing from the carcinomata and sarcomata, that it is generally related to a mole or recent pregnancy; but some investigators have determined that the characteristic tissue may be

found independently, for instance in certain teratomata of the ovary, and even in corresponding tumors of the testis. Along similar lines Teacher (*American Journal of Obstetrics,* 1903) concludes:

(1) That the so-called deciduoma malignum is a tumor arising in connection with pregnancy and originating from the chorion epithelium (or its forerunner, the trophoblast) which is of fœtal epiblastic origin.[3]

(2) That these tumors form quite a characteristic group clinically, pathologically, and developmentally, and that they should be classified neither as sarcomata nor as carcinomata, but as a distinct group *sui generis,* and that malignant hydatiform mole may be treated as a variety of this disease.

(3) That in addition to the common tumors developing from the pregnancy, there are tumors containing precisely similar structures which are not connected with gestation, and may develop in other parts of the body than the uterus, and in either sex. The most probable explanation of them is that they are teratomata, originating from some structure which has the morphological value of an included ovum, and the chorion epitheliomatous tissues represent an actual trophoblast (chorionic epithelium) and the included ovum.

Lockyer (*The Practitioner,* 1904) discusses the neoplasm with especial reference to its association with lutein cysts and excessive lutein reaction. In four instances he claims to have found an excess of lutein tissue, and in three others although the ovaries were regarded as normal (lutein cysts being absent), the solid ovarian stroma was strewn with lutein cells. He concludes that in estimating the amount of lutein tissue present, no help is to be obtained from observations with the naked eye. These cases were cited in favor of the theory of Pick, which is, that where lutein cells are in excess their internal secretion produces a reaction upon the developing ovum converting it into a mole! This is certainly a most ingenious theory, but is believed to be insusceptible of either intelligent understanding, adequate demonstration, or reasonable proof!

With further reference to the observation that neoplasms corresponding in every morphological and pathological detail to syn-

[3] It will be noted that in substance this is only a reiteration of the theory of Marchand. H.

cytioma malignum, as noted in the corpus uteri subsequent to parturition, have been demonstrated in other parts of the body of the female, and also in the male: Hicks (*Journal of Obs. & Gyn. of Great Brit.,* 1907) records an instance of primary embolic chorio-epithelioma of the vagina, and comes to the following conclusions:

(1) These vaginal growths most often follow the passage of a vesicular mole, but like intra-uterine chorion epithelioma may develop after abortion or full term pregnancy.

(2) They may occur while the mole is still in the uterine cavity; they originate from the epithelium of migratory embolic villi. There is no evidence to show that a malignant tumor or mole can be expelled from the uterus and leave that organ free from growth, while metastatic enlargements may occur in other parts of the body.

(3) The growth spreads via the perivaginal veins; there is no means of determining whether any given mole will be followed by chorion epithelioma. The large quantity of syncytial masses observed is very characteristic of vaginal chorion epithelioma.

Walthard (*Zeitschrift für Geb. und Gynak.,* 1907) describes a most unusual and interesting case in which chorion epithelioma developed in other parts of the body without a primary growth in the uterus! During the second half of an apparently normal pregnancy typical chorion epitheliomata were discovered in the vagina, the kidneys, the liver, and the lungs, without a trace of malignant growth either in the placenta or that part of the uterine wall where the placenta was attached. Since the organs mentioned were examined (evidently post mortem) in serial sections, and thus the absence of a primary uterine growth positively established, the case proves the possibility that a chorion epithelioma may develop from perfectly normal chorion epithelium, or the syncytium, in the absence of vesicular or other degeneration of the chorionic villi!

Fisch (*Interstate Medical Journal,* 1906) in an article on chorion epithelioma in a male suggests that the peculiar histology and fatally malignant growth of this neoplasm have been the incentive for numerous investigations resulting in the generally accepted opinion of an origin from epithelium of the fœtal coverings and villi. Normally this epithelium destroys maternal tissue, enters into the blood vessels, in normal pregnancy is carried with the circulation into various organs of the maternal economy, and is always to

be found in the pulmonary capillaries. Under normal conditions this transplantation does not give rise to tumor formation, since the cells are resorbed. It is probable that as a rule resistance of the maternal organism is sufficient to ward off any danger from this parasitism. Under certain circumstances, however, this resistance yields, the fœtal cells are able to assert their innate proliferative capacity, they become malignant, and no resistance being met with, use the pabulum offered them thus destroying vital tissues of the providing organism. . . . Morphologically and physiologically the cells of a normal chorion and those of a chorion epithelioma cannot be differentiated, they are absolutely alike, only varying in the degree of the respect they hold toward the tissues in which they live. . . . Thus the fœtal epithelium after pregnancy finds in the maternal body a favorable soil, it is free from limitation caused by enrollment into the whole of the developing fœtus, and avails itself thereof by unlimited growth and proliferation.

It has been only a few years since the attention of pathologists was first directed to neoplasms developing in other parts of the female economy than the uterus (and also in males), which could not be explained except as tumors of identical character, *i.e.*, syncytioma malignum, or the so-called chorion epithelioma. Undoubtedly similar observations had been previously made, but the findings were incorrectly interpreted under the biased conviction that such neoplasms could develop only in the female uterus and subsequent to pregnancy. The researches of Pick, Schlagenhauffer and others, confirming the classical studies and investigations of Wilms, have clearly demonstrated the existence of this neoplasm in rare instances in the male sex. There have been but few such cases recorded. Frank collected nineteen, and Nicholson and Fisch have reported one each. As an example a brief abstract of the case recorded by Fisch, and some of his comments thereon, may not be uninteresting:

The patient, a male, aged twenty-six years, consulted the author in regard to a tumor of the right testicle which had been gradually increasing in size for six months. The growth was hard, the overlying skin reddish-blue in color and freely movable over the enlargement. There was little or no pain, but mechanical inconvenience from presence of the tumor was considerable. Further investigation revealed consolidation of the larger portion of both lungs, only

the upper lobes (mainly the left side) appearing to be entirely free. Temperature only slightly elevated, cough and bloody expectoration present. Microscopic investigation of the sputum for tubercle bacilli negative.

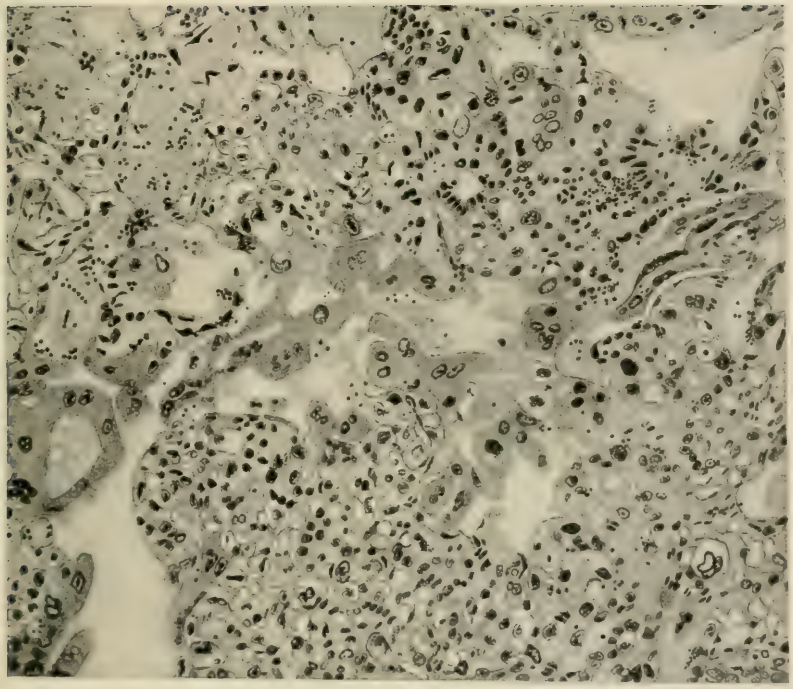
As the general condition of the patient was good, it was considered justifiable to remove the enlarged testicle, which was promptly accomplished. Microscopically the neoplasm presented a picture reminding one of a syncytioma, *i.e.*, only fields of clotted blood with areas of a whitish color could be seen. No normal portions of the testicle could be detected. Microscopical examination proved the neoplasm to be a typical (so-called) chorion epithelioma.

No improvement followed the operation, on the contrary the patient became progressively worse, there was rapid emaciation, dyspnœa, hæmaturia, paralysis, and death supervened five weeks from the date surgery was invoked. Necropsy confirmed the provisional ante-mortem diagnosis. There were extensive metastases into the lungs, kidneys, lymphatics, bronchial and tracheal glands, and the brain. The findings resembled those observed in a number of other similar instances, and were identical with those noted in cases of death from chorion epithelioma developing subsequent to pregnancy. The histological structure of the neoplasm and the character of the lesions were the same down to the finest cytological details, even to the ciliary fringe of the syncytial masses!

In the first place, it is possible to demonstrate in certain portions of the primary tumor, as well as in the metastatic growths, cells that are not chorionic but well differentiated into cubical and cylindrical rows of cells with a fixed position of the nucleus, and often forming typical, small cyst-like arrangements. They in all respects resemble the neuro-epithelium of the fœtus in the earliest stages of its development, and what is more (as Pick has also shown) there are gradual transitions between these cells and chorion epithelium. The typical arrangement and structure appears more definitely even in the metastases than in the primary tumor. The near relation of the two foregoing formations to each other is clear. (Fig 1.)

In the second place, while on superficial examination the primary tumor showed only the structure of a chorion epithelioma, more thorough investigation of numerous portions demonstrated a small area where a typical teratomatous condition obtained, chorion

FIG. 1.



Metastasis to kidney from chorio-epitheliomatous growth of testicle.

cells, cartilage cells, embryonic connective-tissue and columnar ciliated epithelial cysts, and canals being present.

Similar observations have been made before, and they lead us to the conclusion that chorion epithelioma is a tumor, either a constituent of a teratoma, or a tumor in which the teratomatous portion is reduced to a minimum by the excessive proliferation of the former. Whether this is so in all cases is doubtful, but even if it should not be, it would not change the conclusion that must be drawn from the study of the character of these tumors.

While we may assume that in chorion epithelioma following pregnancy the tumor originates from the fœtal epithelium, either due to predisposing conditions of the maternal tissues, or by a specific alteration of the biological character of the epithelium itself, such an interpretation fails in the male tumor. Here we must look for another explanation, and that is given by consideration of the not infrequent teratomatous combination (Fisch).

Henetson (*The Practitioner,* 1906) suggests that metrorrhagia following abortion or labor should call for more prompt investigation, particularly in women under thirty years of age. Dilatation and curettage under such circumstances is an operation entailing considerable responsibility in view of the possibility of malignant disease. The sharp curette is contraindicated in the parturient uterus, likewise in the presence of septic infection. Specimens from all such curettings should be submitted to an expert pathologist for microscopical examination. Metrorrhagia which persists after such treatment is of most serious import, and fresh investigation and prompt radical measures are imperatively indicated.

In the light of present understanding it would appear that a definition of syncytioma malignum more appropriate than any heretofore suggested would be: A malignant neoplasm developing usually within the corpus uteri subsequent to pregnancy, arising in the syncytium probably at the placental site, showing a marked tendency to metastasis, advancing with great rapidity, and almost invariably leading to a fatal termination within a few months. It would also be necessary to specify, however, that neoplasms exactly similar in morphological and histological structure may occur in other parts of the female economy than the uterus, and even in the male.

MANAGEMENT OF PREGNANCY

BY JOHN W. WAINWRIGHT, M.D.
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As soon as a diagnosis of pregnancy is made, the physician should counsel the pregnant woman in the general rules of personal hygiene, since many of the disorders common to this state are chiefly due to lack of attention in this direction. The physician will often find himself called upon to exercise his skill in restraining many distressing symptoms entirely consistent with the normal process of gestation, and it is just these that so often tax the ingenuity and knowledge of the medical attendant.

Since there is an increased elimination of carbonic acid by the lungs through this entire period, an abundance of fresh, pure air is very essential. The dietary should include all nutritious, easily digested articles of food. Constipation must be relieved by proper laxatives. Violent purges should be avoided, since they are a common cause of abortion. The fluid extract of cascara sagrada in 20 to 30 drop doses at bedtime finds favor with most physicians. A pill of aloes, strychnin and belladonna makes a good alternative with the cascara, but its prolonged use is not advisable. An occasional mild enema of soap and warm water often proves of great benefit. It is well to administer during gestation, various tonics in the form of iron mixtures, the hypophosphites, etc. It has been claimed that the routine administration of small doses of strychnin in the latter months of pregnancy will increase the strength of the uterine contractions and thus shorten the duration of labor, but experience has not proven this theory correct. Some advice should be given regarding the proper dress to be worn. Clothing should be loose and easy. Tight garters and tight corsets should be discarded. Chilling of the skin must be avoided. Mild exercise,—walks and drives in the open air,—should be encouraged. Long railway journeys may produce abortion. There can be no question that sexual excess in pregnancy has in many cases a most pernicious

influence. Marital relations therefore should be of infrequent occurrence. The pregnant woman should bathe frequently, that the skin be kept in good condition. The vagina and external genitals should be kept clean by occasional douches of bichlorid of mercury solution 1:3000. Care should be observed that no more than a pint of fluid be injected at a time, and that the injection be made slowly, since gestation has been interrupted by an abuse of this procedure.

Galabin divides disorders of pregnancy into four classes: 1. Those arising from reflex nervous influence, associated with the changes in the nervous centres induced by pregnancy, and the general changes in nutrition which it causes. 2. Those which result from mechanical effects. 3. Morbid conditions of the uterus and ovum. 4. Disease independent of pregnancy, but of such a nature that the disease is influenced by the pregnancy, or the course of pregnancy by the disease.

Referring to the nausea and vomiting the same authority says these are reflex neuroses associated with increased irritability of nervous centres. In some instances painful emotion or sudden mental shock is the starting point of a very severe kind of vomiting. In other cases the tendency to vomiting due to chronic dyspepsia, especially that produced by alcoholism or Bright's disease, is added to the effect of pregnancy and greatly aggravates it. In mild cases the patient should take a little food before getting up. Constipation should be treated. If granular inflammation of the cervix exists or any special lesion, local treatment should be tried and retroversion or retroflexion of the gravid uterus should be remedied and abortion should be induced when the mother's life is endangered.

Disorders of Pregnancy.—Notwithstanding the frequency of the vomiting of pregnancy, and its ofttimes alarming character, medical literature offers little in the form of positive cure for this distressing symptom. Almost all known therapeutic agents have been lauded at some time or other as specific, but calm experience has invariably proven them to be of little value. Much may be gained by a due consideration of the simple rules of hygiene. The skin should be kept in good condition by frequent bathing. Constipation relieved by mild laxatives or occasional enemata. Calomel, ipecacuanha and perhaps a little gamboge has been highly recom-

mended. A case is reported which was successfully treated by calomel and santonin. The valerianate of cerium has been recommended as a substitute for the oxalate, first proposed and employed by Simpson, the objection to the latter salt being that it is so rarely pure. Cocain alone, or in conjunction with the extract of belladonna, applied locally to the cervix has given satisfactory results. Probably cocain given either by mouth or by hypodermic injection, offers grounds for better results. Prominent among the different remedies suggested at one time or another are the following: wine of ipecac, tincture of iodin 1 to 2 drops in water, tincture of nux vomica, valerian, subnitrate of bismuth, antipyrin, ingluvin and hydrobromate of hyoscin. Fordyce Baker recommends carbonic acid water containing a drachm of bromid of potassium to the siphon. Fowler's solution in drop doses at mealtime is said sometimes to exert a favorable influence. Rectal injections of chloral, and morphia in small doses, given hypodermically, will frequently relieve gastric irritability. The habit of taking a small quantity of weak tea or coffee before the patient rises in the morning, often aids in checking nausea and vomiting. Sexual intercourse should be prohibited. In the exaggerated, pernicious or uncontrollable form of vomiting operative interference may be necessary. Before resorting to this procedure, rectal alimentation should be given a fair trial.

Caries of the teeth and severe toothache often occur during the period of pregnancy. Owing to the great susceptibility to abortion in consequence of the nervous shock attendant to operation, it is not wise to counsel extraction of the offending teeth. It is well to remember though, that many major operations, such as myotomy for the removal of fibroids of the uterus and ovariotomy, have been performed without gestation being interrupted. Stratz [1] from a study of 19 cases of pregnancy complicated by ovarian tumors, in 14 of which ovariotomy was performed, concludes that if the operation is necessary, prognosis is not rendered unfavorable by the fact of pregnancy.

Galabin advises for neuralgic pains iron and quinin, if proceeding from carious teeth, extraction or filling should not be deferred on account of pregnancy.

[1] *Zeitschr. f. Geb. Gynek.*, 1887.

Salivation of pregnancy offers another problem which demands attention, but is a neurosis that occurs rarely. It has been relieved by the administration of potassium bromide, also by iodide of potassium and belladonna. Astringent mouth washes sometimes prove beneficial. Ptyalism is regarded as a purely hysterical affection, being more often observed in highly neurotic individuals. Small doses of atropin, pilocarpin and the fluid extract of viburnum prunifolium have been severally recommended.

Pruritus of the skin sometimes occurs as a very annoying complaint, and requires energetic treatment for its relief. Bathing in water to which common soda is added, usually offers the best remedy. In more severe cases, lotions of diluted carbolic acid or tannic acid in glycerin, frequently afford relief.

The eruption known as "herpes gestationis" when it becomes pustular and severe, sometimes ends fatally. It is described by Hebra as "impetigo herpetiformis." General pruritus of the skin appears very rarely as a neurosis. Pruritus of the vulva is more or less common; in the treatment of this condition any source of leucorrhœa should be treated and the bowels should be kept acting freely.

Cough, Dyspnœa, Palpitation and Syncope.—Cough of pregnancy is often of a spasmodic and reflex nature. Dyspnœa and palpitation, in the absence of heart affection, may be reflex or partly the result of anæmia. Syncope does not necessarily mean heart failure, but is very closely allied to the apparent fainting of hysteria.

Chorea.—This affection is not a frequent complication of pregnancy but after childhood it occurs more commonly in conjunction with pregnancy, so it is probable that pregnancy may be a strong predisposing cause. Chorea manifests itself in its most serious and fatal forms during pregnancy and must therefore be regarded in a much more serious light than the ordinary chorea of childhood. Spiegelberg gives a mortality of 27 per cent. from this cause, Schrock 22 per cent., Buist 17.5 per cent., Barnes 3 per cent., and Wall and Andrews 12.5 per cent. Chorea during pregnancy is less amenable to therapeutic measures than at other times of life. The maintenance of nutrition is the most important point. Tonic treatment should also be employed, especially the use of iron. When

attacks are particularly violent, sedatives may be indicated and in the most serious cases artificial abortion is called for.

Albuminuria.—The presence of albumin in the urine is said by some observers to be frequent with parturient women; they argue from this that its significance in cases of puerperal convulsions is greatly minimized. Blot, Litzmann, Petit and Hypolitte have published observations in which they found albumin in the urine of more than 20 per cent. of women during or just after labor. In Guy's Hospital, on the other hand, out of 200 cases in which the urine was tested about the time of labor, albumin was found in only four. Galabin thinks that the explanation may lie in the fact that the European observers used more delicate tests, and so recorded very slight traces of albumin. Such a degree of albumin stands widely apart from that usually associated with eclampsia, for in that it is generally present in large proportion. Little, however, in 1,000 pregnant women whose urine was examined in the Johns Hopkins Hospital, records that there was found, a considerable proportion of albumin, together with tube casts in 7.3 per cent. of the cases. For cases in which albumin is present in considerable quantities the usual treatment must be pursued. For cases in which the albumin appears to be wholly due to the toxæmia of pregnancy, treatment by thyroid extract has been suggested by Nicholson. If there is œdema towards the end of pregnancy, or if the proportion of albumin is large and increasing, premature labor should be induced.

Eclampsia.—This condition is rare although its frequency would seem to vary in different countries. Galabin thinks that its association with albumin is so general as to prove absolutely that a causal relation exists. Either the eclampsia results from the nephritis or the albumin from the eclampsia, or both are the result of a common cause. Nevertheless, as mentioned before, this is by no means the view held by a large number of prominent authorities in Europe and America who are of the opinion that the connection between the presence of albumin and eclampsia is of no special significance. According to statistics on the subject, eclampsia occurred once in 842 deliveries in Guy's Hospital charity work, the fatal cases amounting to 1 in 3,368 deliveries. In New York City from 1867 to 1875 fatal cases amounted to 1 in 700 deliveries. The general

estimate for Europe is about 1 fatal case in 500 deliveries. A marked feature in the occurrence of eclampsia is the special liability of primipara to the disease.

The prognosis of eclampsia is grave, the mortality now being reckoned at from 20 to 25 per cent.

As soon as convulsions occur an active purgative should be given and venesection should only be done as a last resort. The main object should be to limit the number of convulsions, the most effective means of reaching this end—according to the best authorities—being subcutaneous injections of morphia and the administration of chloroform. Pilocarpin may be administered subcutaneously, and some physicians in this country recommend the subcutaneous administration of tincture veratrum viride. Nicholson has suggested the administration of large doses of thyroid extract and favorable results therefrom have been reported.

If labor has not commenced and the case is mild, an expectant course may be pursued, but if the case be severe it would appear advisable to empty the uterus. Hermann thinks that no advantage is to be gained by such a procedure, while on the other hand Zweifel shows a mortality of 28.5 per cent. under expectant and one of only 11.2 per cent. under active treatment. Other disorders of pregnancy are mostly mechanical. Œdema of the lower limbs frequently occurs as the result of pressure of the gravid uterus. In such cases standing should be avoided as much as possible and the bowels should be kept well open.

Varicose veins often are an accompaniment of pregnancy chiefly in primipara, and should be treated by keeping the legs elevated. Hæmorrhoids are frequently produced by pressure on the rectal veins and by constipation. Operation is not advisable during the pregnant period.

It is of the utmost importance to examine the patient's urine frequently during the entire period of pregnancy. To avoid contamination of the vulva by vaginal secretions, the urine should be drawn off by means of the catheter. The appearance of the smallest amount of albumin demands a guarded opinion although albuminuria is not an infrequent occurrence during pregnancy, due, probably in the milder cases, to a temporary catarrh of the bladder. The patient should be advised to wear woolen underwear, the action

of the skin should be maintained by occasional warm baths, alcohol should be avoided, and the diet should consist largely of milk. Regarding the treatment to be followed in cases of albuminuria, no fast rules can be laid down. Basham's mixture, in teaspoonful doses four to six times a day, has been recommended. Recently, benzoic acid has been lauded most enthusiastically, although observation has not demonstrated it to be superior to other diuretics. In very severe cases, the interruption of the progress of pregnancy may have to be considered.

For the proper performance of labor, the physician should see that the following enumerated articles be in possession of the attending nurse:

(1) 1½ yards $^{6}/_{4}$ rubber sheeting.
(2) Absorbent pads.
(3) ½ pound sterilized absorbent gauze.
(4) 1 sterilized sponge.
(5) ¼ pound borated cotton.
(6) One 2 quart fountain syringe.
(7) Two glass vaginal douche points.
(8) One glass catheter.
(9) Douche pan.
(10) One spool sterilized braided silk.
(11) One hand brush.
(12) 2 ounces carbolic acid.
(13) 2 ounces lysol.
(14) One ounce Squibbs' chloroform.
(15) One bottle bichlorid of mercury tablets.
(16) Four ounces tincture green soap.
(17) One jar sterilized vaselin.
(18) Mull binders (36 x 48).
(19) ½ ounce 1 per cent. argent nitrat.

The necessity of the most thorough antiseptic precautions must here be dwelt on, statistics showing that the mortality due to puerperal septicæmia in all countries exceeds that due to the difficulties and accidents of labor. Consequently every precaution must be taken against the occurrence of septicæmia. The most important element of danger in this respect consists of the possible introduction of virulent germs into the genital canal which must be pre-

vented by strict antisepsis. Opinions differ as to the use of antiseptic douches before or immediately after labor. Galatin thinks that in private practice antiseptic douches are, at any rate, of less essential importance than the establishment of a technique which prevents the conveyance by accoucheur or nurse of virulent germs. The external genitals should be washed by the nurse with soap and water at the outset of labor and then carefully cleansed with an antiseptic solution, since septic cocci are said to be commonly present in the vulvar secretion though not in the vaginal secretion.

The room in which the patient is to be confined should be as airy as possible and also quiet. The bed should be firm. The bedding should be protected by a waterproof sheet, and a draw sheet folded in several thicknesses should be placed under the hips, so that it can be readily removed when soiled. It is preferable that the patient should be in her night clothes. The plan is often adopted for the woman in labor to wear underneath the night dress a special petticoat fastened loosely round the throat.

As to the position in Great Britain it is the custom for the woman to lie on her left side, during the latter stage of labor, or for an examination. In Europe and in this country the dorsal position is the usual one.

In the management of the puerperal state, the most essential points are to secure for the lying-in woman rest, both bodily and mental, for a sufficient period. The patient therefore should not be excited by visits from friends, and all likely sources of inducing emotion should be guarded against. The ventilation of the room should be closely looked after, and care taken that it is not exposed to foul or other septic exhalations from whatever source. The room need not be darkened, except when the patient finds the light trying. The external genitals should be washed several times a day with an antiseptic.

As soon as labor ceases, the first part of the management of the puerperal state commences. The slightest infringement of the rules relating to good nursing may mar the final success of an otherwise brilliant accouchment. Scrupulous cleanliness must be insisted upon throughout the entire puerperium. It is safe to say that, as regards puerperal fever, prevention is not only better than cure

but it is practically the only cure. The utmost pains should be taken to insure perfect cleanliness in the surgical sense, of the hands, finger nails, and of the irrigating appliances that come in contact with the genital passages. It is well to note here that personal disease in the medical attendant or in the nurse, such as discharges from the nose or ear, may be the cause of septic infection. In such cases, the infection is usually conveyed by the fingers, which have become contaminated with the purulent discharge. Several fatal instances have been reported, in which the sepsis was clearly traceable to such a cause.

It is a good routine practice to administer as soon after labor as is consistent, a vaginal douche of a warm bichlorid of mercury (1 : 4000 to 1 : 2000) solution. This has the effect of removing any blood clots which may have accumulated in the vagina. These douches should be continued, once daily in ordinary cases, throughout the whole lying-in period. Should fœtor of the lochia appear at any time, the physician should proceed to give a thorough vaginal douche of boiled water or of some antiseptic solution. As a rule the fœtor will disappear after one or two thorough vaginal irrigations. In such cases, the underlying cause will be found to be decomposition of a blood clot in the vagina. If the fœtor persists, the cause may be assumed to be some retention within the uterus. This calls for an intrauterine douche, which must be carefully performed since grave accidents may occur. Several cases are reported in which alarming symptoms of poisoning by mercuric bichlorid developed in consequence of the too energetic employment of strong solutions of this antiseptic. In cases where it is apparent that severe septic processes are going on, curettage is clearly indicated.

Mercurial douches are not so generally used after labor as was at one time the case. It is the custom to discard mercurial douches in normal cases at the Maternity Hospital of New York. At that institution douches of creolin emulsion 1 per cent. are used before delivery. The genitals are washed with the same after delivery, and an occlusion bandage is then applied containing a pad wrung out of the same creolin emulsion. This is changed every two hours, or whenever the patient passes urine.

If labor has been unusually severe and the patient is restless an opiate may be given, but this procedure should not be followed

as a rule. If after pains are very troublesome a mild anodyne is sufficient to meet the case.

After the patient has been carefully washed, she should be placed on clean dry bedding and then permitted to enjoy a few hours of refreshing sleep. A cup of hot tea or bouillon may be relished by the exhausted mother. The diet during the puerperal period should be selected with due regard to the physiological requirements of the patient. During the first three or four days, it should consist of gruel, milk, milk-toast, clear soups, and tea. Later, soft boiled eggs, delicate chops and the like may be permitted. After the bowels have moved on the third or fourth day, a more liberal diet may be indulged in. To insure the speedy establishment of the secretion of milk, it is well to administer abundant quantities of fluids, milk, tea, and the like. Cooked fruits will aid in overcoming the natural constipation associated with this period.

It was formerly the custom to keep lying-in women on low diet. Authorities, however, are now agreed that the better they are nourished the more likely they are to resist disease. It is now considered that they should have from the first, nourishing food in a digestive form and a fair allowance of milk. There is no harm in giving fish, chicken, or digestible meat, even before the third day, if the patient likes it, and in the absence of any rise of temperature or constitutional disturbance of any kind. The physician should visit the patient within twelve hours after delivery and daily for the first week. The temperature should be carefully recorded.

About the third or fourth day, the bowels should be relieved of their contents by administering a half ounce of castor oil, followed in three or four hours by an injection of soap and olive oil in water. Milder laxatives, such as compound licorice powder, compound rhubarb pills or a wineglassful of Hunyadi-Janos water may be given with advantage. In those cases where hæmorrhoids complicate the puerperium, half grain doses of aloes administered morning and evening prove very serviceable. After the bowels have moved, the anus and vulva should be carefully washed. If laceration of the perineum be present, it is well to allow a mild solution of lysol to flow over the wounded surface.

It may be necessary during the first 24 hours to resort to the use of the catheter for the purpose of removing the contents of the

bladder. Extreme care should be observed in the execution of this procedure. The urine should be drawn at least three times in the twenty-four hours. After washing the vulva, the labia should be separated and the meatus carefully cleansed with a little cotton saturated with an antiseptic solution, and the catheter introduced. It is bad practice to attempt to perform catheterization without exposing the genitals. The serious consequence of a septic cystitis should be constantly borne in mind. Should such a condition develop, energetic treatment must be pursued. If the disease be mild, the internal administration of salol in doses of five grains, four to six times a day, may suffice to bring on relief. In severe cases, the bladder must be irrigated with a warm saturated solution of boric acid. If the determining cause be a gonorrhœal urethritis, silver nitrate sol. 1:1500 should be substituted for the boric acid, or better still, alternated with boric acid.

Osler says that in five out of nine cases of pernicious anæmia in women, he traced the condition as beginning in the puerperal period. In such cases, Fowler's solution, beginning with fifteen drops, and gradually increasing the dose to twenty-five or thirty drops, seems to act like a specific.

Duration of Lying-in Period.—The patient should not be permitted to leave her bed before the tenth day. In cases where there are wounds (laceration of cervix or perineum) to heal by granulating, a much longer period of time should be insisted upon. Garrigues'[2] apt rule that the upright and sitting postures ought to be carefully avoided until involution has proceeded so far that the uterus has seceded from the anterior wall of the abdomen and returned to the pelvic cavity is a safe one to follow. Heavy household duties must be postponed until such time when the mother can indulge in them without fatigue or exhaustion.

Nursing.—The child should be brought to the breast within the first twelve hours following the termination of labor. The early application of the child to the breast seems to promote uterine contractions, and thus lessens the possible occurrence of postpartum hæmorrhage. The intervals between the acts of nursing should not exceed two or three hours, and it is wise to accustom the child from an early period to suck the breasts at stated intervals. Such a

[2] *Am. Journ. of Obstet.*, Oct., 1880, p. 861.

practice will allow the mother to direct her attention to household duties and will permit her to enjoy occasional hours of rest or recreation. The breasts should be attacked in alternation. Before and after each nursing, the nipples should be washed with some antiseptic solution, preferably boric acid. Extreme sensitiveness of the nipples can be relieved by the application of a diluted solution of alcohol and water, tincture of benzoin, or a lotion of the subacetate of lead in the proportion of a drachm to three or four ounces of water. It is sometimes necessary to make use of a nipple shield on account of the exquisite pain occasioned in nursing. Fissures of the nipples may be touched with the point of a stick of nitrate of silver, or a lotion consisting of boric acid, twenty grains, mucilage acacia, one ounce, may be applied with a camel's hair brush. As the secretion of milk is never fully established before the second or third day, it stands to reason that no food other than colostrum is required before that time. Hence the practice of giving the babe occasional draughts of sugar water, fennel seed tea and the like is worse than useless.

Lactation should not be continued after the puerperal period, either if the milk is poor in quality, or if the mother's health is so delicate that injury to her is to be feared. The breast may become knotty and painful when the milk is first secreted. Gentle friction is then indicated, and if the infant is not able to suck strongly, it may be desirable to draw a little milk with a breast glass. If, however, suckling is not intended and the milk is to be suppressed, friction or drawing should be discouraged. The breasts should be supported if swollen and tender, and gentle pressure made upon them. Little fluid should be drunk and the bowels kept open by a saline purgative. When milk is insufficient in quantity suckling should be at longer intervals. If milk is deficient a fairly generous diet of nitrogenous food, with plenty of liquid should be taken.

With regard to the nursing capabilities of mothers and alcoholic heredity, Bunge has sent blanks to a number of physicians in Switzerland, Germany, Austria, Russia, Hungary and Turkey, inquiring with respect to the connection between alcoholism in the father and the nursing capacity of the daughters. His statistics show that chronic alcohol poisoning in the fathers has a great influence on the daughters and also on the resistance of children

to tuberculosis and nervous affections. He received 1,629 replies. Of the total number 1,110 women were unable to nurse their children, and in the 716 cases in which the mother's capacity was mentioned he found that the mother likewise had been unable to nurse her children in 60.8 per cent. With a single exception, the 422 nursing women had mothers who had nursed their children. This shows the marked hereditary character of the nursing capacity.

The date of weaning cannot be exactly fixed for all cases, since it must depend upon two factors,—the health of the mother, and the development of the child. Change in the manner of feeding may be accomplished gradually or suddenly. Each individual case must be governed by existing circumstances.

During the period of lactation, severe mental and physical fatigue must be avoided. The mother should have sufficient exercise to maintain a healthy appetite and digestion and regular hours for rest, sleep and recreation. The diet should be plain, nutritious, and easily digestible.

The period of lactation should not be chosen as a time for major operations. The necessary rest in bed after them and the forced dieting have an unfavorable effect on the secretion of milk.

Care of the Newborn.—As soon after delivery as possible the nurse washes and dresses the child. The infant is washed in a warm bath with water and soap. The eyes should be thoroughly cleansed, and this should be done every day with warm water. Fresh tufts of absorbent cotton are best adapted for this purpose. In order to prevent the occurrence of ophthalmia neonatorum, one-half to two per cent. nitrate of silver solution should be instilled into the eye and neutralized after a few minutes with mild sodium chlorid solution.

It is important that the mouth be kept in a cleanly condition. It may be wiped out with soft lint moistened with two per cent. boric acid solution.

The cord may or may not be dressed daily. The more frequent custom now is either to wash it or to express from it the excess of gelatine, to dust with subnitrate of bismuth and wrap in aseptic gauze or absorbent cotton, and then wrap the pad round the abdomen. After the cord separates a folded pad of dry linen should be placed over the umbilicus until it has completely cicatrized.

The binders and clothing should be warm but not tight. The child should be bathed daily, although some prefer not to put it into water until the cord separates. Attention must be paid to the bowels, if not relieved twelve hours after birth; sometimes a hot bath will have the desired effect. The temperature should be looked to. The average rectal temperature of the healthy infant is about 99°. The average variation in pulse rate is about 120 to 150.

Constant cleanliness and dryness of body of a new born infant are necessary, and care should be taken that the napkins are not washed in soda and water as this chafes the skin.

The nursery should be airy, well ventilated, and so situated that it obtains plenty of sunlight. In the day the temperature of the room should be 68° to 70° F., at night 60°. No gas or oil stove should be in a nursery. After three weeks have elapsed since birth, the child may be taken out of doors daily in fair weather, to derive all the benefit possible from sunlight and fresh air.

Infants should be fed at regular intervals, and put to sleep at the same time daily or in the evening. The most essential point in the successful rearing of a child is the manner of feeding. It is well understood that artificial feeding, which is so largely practised nowadays among all classes, is responsible for much of the large mortality in the infant period. There are of course always a large number of women who are unable to nourish their babies properly, but there is perhaps a still larger number who are able to feed their infants at the breast but will not do so. Thus the question of artificial feeding is a perennial one, and has given rise to unlimited discussion. The aim is to modify cow's milk so that it will closely resemble in its composition mother's milk. This, however, has been found to be almost impossible, and cow's milk in whatever way it may be modified is after all but a substitute for human milk.

Caille truly says that in the home modification of cow's milk the greatest simplicity is desirable for all concerned. The following simple method has been practised by him for the past twenty years and has given excellent results. If a quart of good clean milk stands four hours the upper half of the milk will contain about twice as much fat as the lower half. This pint of so-called top milk is decanted and forms the basis of the food.

By diluting this top milk in various proportions, viz: 1 to 1,

1 to 2, 1 to 3, 1 to 4, 1 to 5, a food is obtained of various strengths as regards fat and proteids. The deficiency of salt and sugar is made up by the addition of these substances as follows:

Synopsis of Caille's method of home modification of cow's milk:

COMPARATIVE TABLE

	Fat	Sugar	Proteids	Reaction
Human milk	4	7	1½	alkaline, sterile
Cow's milk	4	4	4	acid, not sterile

1. Reduce the proportion of proteids by dilution.

2. Increase the quantity of fat originally sufficient but made insufficient by the necessary dilution.

3. Increase the sugar and salt made insufficient by the necessary dilution.

4. Make the cow's milk alkaline by adding lime water.

5. Sterilize or pasteurize in warm weather, or for special cases.

A more simple method for home modification is as follows: Dilute home-made top milk (not store cream) with boiled water or farinaceous water and add granulated sugar, table salt and lime water as follows: No. 1. Sugar, two tablespoonfuls; salt, one-half teaspoonful; lime water, two tablespoonfuls; diluent, twenty-six ounces; top milk, six ounces. No. 2. Sugar, two tablespoonfuls; salt, one-half teaspoonful; lime water, two tablespoonfuls; diluent, twenty-four ounces; top milk, eight ounces. No. 3. Sugar, two tablespoonfuls; salt, one-half teaspoonful; lime water, two tablespoonfuls; diluent, twenty ounces; top milk, twelve ounces. No. 4. Sugar, two tablespoonfuls; salt, one-half teaspoonful; lime water, two tablespoonfuls; diluent, fifteen ounces; top milk, 15 ounces.

No. 1. For young infants (one month) and difficult feeding cases. Feed one to two ounces every two hours (twice at night).

No. 2. Adapted for young infants with good digestion or for infants two to three months old. Feed two to three ounces every two hours (twice at night).

No. 3. Adapted for infants from four to eight months old. Feed four to six ounces, every two and a half to three hours, eight feedings in twenty-four hours (once at night). After the eighth month give six bottles and two feedings of corn pap starch with egg, or mutton or beef broth with rice or sago.

No. 4. Rich milk adapted for children over one year old. Give five bottles, six to eight ounces each, and two additional feedings as above.

Put the mixture into small nursing bottles each to contain one feeding and cork with a pledget of clean cotton. Keep raw and pasteurized milk food on ice. Before feeding heat to body temperature by placing the bottle in hot water. Then remove cotton and feed by means of a rubber nipple. Caille says that as this method of modifying cow's milk does away with the addition of separated cream, it has a distinct advantage over the so-called cream mixtures in that separated cream is not invariably fresh and is prone to spoil and give rise to dyspeptic diarrhœas and other forms of milk poisoning.

The modifications of cow's milk are numerous, many of them elaborate in the extreme, but it is probable that a simple method like that described above will answer the purpose equally well. It has the advantage too of being easily prepared at home. The fact is a curious one that mothers of the poorer classes, and not only of the poorer classes, will not take the trouble either to buy or prepare modified milk, but will give their infants mixtures of their own devising, or artificial foods of any description. Another difficulty with which infants have to contend is that the milk sold by dealers can by no means always be depended upon. Often it is badly contaminated, and although it may be sterilized this process even when properly carried out does not destroy all the hurtful germs, and in addition destroys some of the nutritive properties of the milk. Breast feeding should always be followed when possible, and if it be not possible, then wherever a fairly pure milk can be procured home modification is perhaps the next best plan.

IMMUNITY AND VULNERABILITY

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Few, if any of us, have doubted that cancer of the human body is at the start a purely local disease, and of local origin. Perhaps, no better evidence of this now fixed medical opinion can be afforded than what is often seen in the development of this disease at its most frequent site in women. Cancer is unquestionably more frequently present in women than in men; and in most instances it is in her womb, especially in the neck of her womb.

The evidence of this relationship in her of the cause and the effect, is so clear, so direct, and, to me so unmistakable that, any physician, it seems to me, need not err, notwithstanding Sir. J. Williams of London, one of authority, who disputes it. He says "lacerations of the cervix uteri play no part in the causation of cancer of the uterus;" for he contends that, "if an irritation local is the cause, the disease would be met frequently in the procident uterus."

Cancer is five times more frequent in the uterus than in any other organ of the body, the mammary gland only excepted; and in the majority of cases of uterine cancer, it is the cervix, not the corpus uteri which is affected. As carcinoma almost always shows itself in women, who have had one or more children, and in the advancing years of their lives, it seems rational for us to infer that sex, parturition and age are potent etiological factors in this disease. The coincidence of epithelioma of the cervix uteri and a multiparous os is, as we usually find it, too frequent to be explained as a mere chance.

It has been my lot to encounter a few, a very few relatively speaking, cases of cancer in the corpus uteri. Of course, I mean in its initiatory stages, before the cervix and the surrounding parts had become implicated. Most of these few cases occurred in virgins or in the married who had never undergone parturition.

The same etiological facts pertain, it is well thought, to the localization of cancer in the mammary gland—the second most frequent site of this disease, in women. This conclusion is well strengthened by instances where a true carcinoma has developed as a sequence to long-continued irritation (say twenty years) of Paget's disease of the nipple. I can now recall but three well-marked cases of mammary cancer in virgins. These were thoroughly amputated and exsected. No return at the original sites ever presented itself, but in two of the cases, years afterwards, cancerous manifestations were clearly noticed in other parts of their bodies. Paget's disease of the nipple is not a malignant disease at the start; its stage of innocency is of an indefinite, uncertain duration. It is curable by resorting to conservative methods of treatment; but it becomes serious and malignant in time, demanding radical surgical interference for its cure. So may a local irritation of the lip, or of the cervix uteri take on similar very serious changes.

Gastric cancer not infrequently follows a prolonged irritation of a stomach ulcer, or a gastric catarrh. The local disturbance of gall stones invites a cancer of the liver. An epithelioma of the lip does follow the frequent use of the smoking pipe. Warts and tumors as well as old ulcers, cicatrices and eczemas do, at times, take on malignant changes. Cancer of the scrotum in the chimney sweeper is an instance. The transformation of an innocent into a maligant tumor, or the change of one form of malignancy of a neoplasm of this kind into another of a more malignant type may reasonably be assured.

Thus, for more than a single consideration, we have reason to believe that there is a gradation in the type of certain tumors at times. Some neoplasms possess a combination of distinct characteristic features. These possible transitions of pathological entities depend in small degree on the peculiar individuality of the persons so afflicted, on sex, on age, and on special inherent or acquired vulnerabilities. Perhaps in no class of cases is this inference better confirmed than in the structural alteration which takes place in the uterine cervical walls from an old and long neglected laceration of its tissues following parturition.

The hyterical girl, or the young girl, born of a neuropathic family, does unquestionably show a stronger predisposition, under

a milder provocation, to certain forms of mental aberration than does her well balanced or self-poised sister. This fact shows how vaso-motor disturbances are frequently at the root of many cases of idiopathic neuralgia. The remarkable manner in which this pain comes and goes, or increases and diminishes in intensity supports this view, as does its special amenability to remedies and measures which control the vaso-motor centres. A careful and painstaking investigation of the peculiar constitutional conditions determines the successful management, in that the employment of mere pain-relieving remedies, while no attempt is made to fulfill causal indications, will often do more harm than good. Therefore, in all of these manifestations, certain hereditary and constitutional proclivities are not to be ignored.

Now it must have been noticed by not a few of us that there is seen through the vaginal speculum, positive evidences of a split in the neck of the womb, on one side, more often on both sides of it, as: erosion, granular degeneration, eversion, hyperplasia, some uterine catarrh, and some noticeable lines of an attempted union of tissues, in married women, women who we have reason to believe have not had a child for many years. There are no cancerous appearances and probably there never will be any. The same causes, however, which seem predisposed to cancer have been operating in this situation, but no serious effects are discernible. What is the explanation of this?

We have reason to believe according to certain writers that cancer represents a morbid proliferation of certain normal cellular elements as the result of a diminished inhibitory action on the part of the surrounding tissue. There is an individual proclivity in some persons to this disease as there is a vital resistance in others against it. Everything which tends to senility, local and general, as mental worry, disappointment, and humiliation assert their influences as likely predisposing causes. Malignant activity, as Bryant says, is measured, by the inherent nature of the morbid process, or by the receptive character of its host; sometimes by both. Helpless, indeed, is that individual, who is the victim of both. How often in our work as practicing physicians do we see cases in which the same causes, identical in kind and in force act differently, or in a certain proportion of cases are devoid of any effect whatsoever. The

constitutions of no two individuals as regards their reaction towards any morbid process are identical.

As to the influences of alcohol these differences are quite noticeable. A careful study of four hundred alcoholics, by Forel, of Zurich, emphasizes the great importance of heredity. Forty-three per cent. of the cases had one or both parents who were alcoholics. Fifteen per cent. of these patients were wholesale or retail liquor dealers. All the cases showed various physical, mental or moral alterations. Fourteen per cent. were epileptics. Insanity, it is well established, varying as it does in frequency and in severity, in different individuals, means an undue instability of a nervous organization.

Driven as we are to an explanation of the varied manifestations of disease in different persons, we console ourselves with the idea that there is and must be a changed entity, a susceptibility in some, a temperament peculiar—a dyscrasia, a diathesis distinctive, modified it may be, by age, by modes of life, by social relations, and by climate, as well as by nationality and by race. Why the same causes do not induce the same effects in all persons is a question difficult to answer.

The word dyscrasia implies a morbid condition of, or a tendency to, certain affections. Such an one, we say, has a special susceptibility to, or rather a proclivity for, certain morbid expressions.

We speak of the varied temperaments: the sanguine, the nervous, the phlegmatic, or the lymphatic. We have strong reasons to believe that there is a well-recognized variability of these temperaments in their impressibility to disturbing influences. We take cognizance of a most marked dissimilarity in both men and women as regards this vital bodily resistance, inherited or acquired, against the inroads of pain, disease and injury, and to the effects of surgical operations. Some patients, we know, succumb to the action of injurious agents of various kinds; others resist them to a remarkable degree. Recovery from an illness depends more often upon the individual who is diseased or injured than upon the severity of the illness or injury from which he is suffering. Some of the most extraordinary recoveries it has been our fortune to witness and to manage have been attributable in no small measure to an unknown

peculiarity of a reserve force in the constitutional makeup of the afflicted.

Much as we differ as to our susceptibilities and to our vulnerabilities, so we are unlike as regards our immunities to disease. Certain immunities we inherit, and these are spoken of as natural; more often the immunity is acquired. Acquired immunity may last for certain infections during a life time, whereas for other infections it may be quite fleeting.

There is stored, as it were, in some a certain resisting force to kill or to expel from the body the morbid germs, in our actual conflicts between the counteracting powers implanted in us and these microscopic invaders of disease. We possess a certain power within us to limit spontaneously the extension of an infecting and infected area. Morbid action usually tends to a point of natural cessation. The products of diseased action and its effects are often spontaneously removed from us.

Our bodies then are not helpless, but our resisting forces are subject to innumerable susceptibilities and various degrees of vulnerability. Because of these virtues implanted in the human organism the ability to resist all sorts of unfavorable environments is characteristic of man more than of any of the lower animals. Probably this is the reason why we suffer comparatively little from our indiscretions.

For many years, in prescribing for women, it has been my judgment as a practitioner, to be influenced materially in the prognosis of the disease and in the selection of certain remedial agents for its relief by the appearances of the temperament, or the constitution by which I am usually guided. The brunette for the most part belongs to the sanguine temperament; while the blonde is of the nervous or the lymphatic type of organization. The brunette of dark skin and dark eyes with a copious crop of dark, rather coarse hair and of a firmer muscle is, as a rule, stronger, enduring of longer life and is not so susceptible to disease. She is less nervous; she is more stable, in her mental and emotional balance; in fine, she is stronger, and more robust than her blonde sister. The blonde of light complexion, blue eyes and light hair is a finer, but a less strong structural composition. She is more susceptible to emotional disturbances, feels grief more poignantly, succumbs to diseases of

the infectious and nervous variety more quickly, has less enduring force of body, and oftentimes possesses smaller viscera than the brunette.

Calomel, without any doubt, as a cholagogue or as an intestinal antiseptic is more frequently indicated and required for brunettes than blondes. The former bear this medicine better. On the other hand, iron and arsenic, single or combined, are more often called for in the administration of medicinal agents to blondes than to brunettes. Quinia also seems to do better for them.

There is no recognized disease which the gynecologist is obliged to treat which is so signalized distinctly with the many and annoying disturbances, local and reflex in kind, as is a laceration of the cervix uteri followed by its secondary changes. Local pains there are, but reflexes there are too; in some cases so pronounced, so very aggravating that they cannot be completely or permanently relieved save by the removal of the condition which causes them. This is not always true, for some cases have no general symptoms, and hardly can realize what ails them when informed of the cause. So much for the difference in person, based upon the physiological interchange of action between the local irritant, whatever it may be, and the special irritability of tissue. Some patients seem to be, as we say, a bundle of nerves.

A most vulnerable subject to the influence of shock and the loss of blood, is the large, fleshy, and flabby person of the lymphatic temperament. The negro makes a poor patient, both physically and morally. He is often tubercular, if not syphilitic. While exempt, speaking comparatively, from cancer, and while an immune to yellow fever, he is prone to elephantiasis, to tetanus and to all of the strumous conditions. Morally, he is a very uncertain quantity. His brain weighs less than the Caucasian, both in gray and in white matter. Although he has been for ages with the white race, and in the highest civilization, he has still kept his primitive condition, and as a race he has never risen to eminence.

Phthisis is not inherited; cancer is not transmitted from mother to daughter, but the offspring of either, born subsequently to any early manifestations of these diseases in their parents, are products of a kind more vulnerable, and hence more prone to these infirmities. In this sense only are these diseases inherited.

I have referred to the greater prevalence of cancer, in the advancing years of life. Senility of tissue, local and general, is evidently a strong predisposing cause. Local injury and local irritations are potent etiological factors in the older years of life. While the experiences of all of us substantiate this belief, we ought ever to bear in mind, how every mental and emotional disorder: as over-work, prolonged anxiety, distress and excesses of all kinds may and do produce the whitened hair, the arcus senilis, the pale blood, the arterio-sclerosis, the failure of nutrition, and the defective tone; and how they do at times develop the diathetic taints: rheumatic or gouty, which otherwise would have remained latent within. Nor, can we disassociate the mental factors, as contributing causes of cancer.

Individual peculiarities are thus almost unbounded, in modifying the outbreaks, the force, the duration, and the complications of disease. This is true, whether we study morbid action, as the dermatologist, in the urticaria of a lobster feast, the eruption of a small-pox, or of an eczema; or whether as the obstetrician, we consider morbid action, when we take into account the reflexes of pregnancy, or the dangers of a puerperal eclampsia; whether as the gynecologist, when we attempt to solve, why one woman has hysteria, another a neuræsthenia, a neuralgia, or some form of insanity, while still another is exempt from all; yet in all the same causes have been present. Whatever individual peculiarities there have been and are, so there always will be more or less.

There can be no doubt that in the origin of many pathological changes and of disease certain qualities originate, partly in the congenital propensity, and partly acquired in some way or manner, which play a rôle of great importance in our course of life.

Predisposition and immunity are especially active factors in the origin of infectious diseases. The human race shows a strong predisposition to, and a marked susceptibility for, certain diseases: small-pox, vaccinia, measles, influenzas, etc., so that the majority of persons acquire some of these diseases at some time in life. Now and then, there is one, who is not susceptible to measles, or to vaccinia, or to scarlatina. It is not, however, possible to determine beforehand exactly, to what extent this peculiarity exists; for it varies according to age, sex, race, time, and individual idiosyncrasy.

It simply behooves us to make our patients as immune as we can against the inroads of any disease.

Truly we are what we are, by what we inherit, plus that we acquire. Every one is largely the outcome and the product of his or her own ancestry. We are largely what we are by virtue of our inheritances, modified somewhat by our environments. Shaped, too, we are by our personal adaptation to our surroundings. In a certain sense there is no local disease. Every local disorder, every morbid change, restricted to some special region or organ of the body, has its constitutional reaction and relation. Every general disease, so-called, has its local manifestation, in place or in degree, revealed, as it must be, by the indiosyncrasy, the immunity, the predisposition and the vulnerability of the patient.

As the physician and the surgeon cannot always satisfactorily explain to himself the *why* and the *wherefore* of some physiological movements of the body, or of the many manifestations of morbid action, nevertheless, it seems to me that, a thorough consideration of the temperament, the idiosyncrasy, the diathesis might be profitable, as well as interesting to us all. "Blood will tell," it has been well said. To be most successful as physicians and surgeons, in our daily ministrations, we must treat our individual patient, as well as treat his or her special disease or injury. A good inheritance, added to which is a life simple, plain, temperate, systematic and regular, counts for much, in our conflicts with the world.

It is well then to read the records of one's ancestry. The pedigree of disease is an old story, but ever should it be a new problem for us to solve. As physicians and surgeons we cannot eliminate, but we should carefully estimate the personal equation of any one entrusted to our care. We are not expected to "gather grapes from thorns, nor figs from thistles."

Genito-Urinary Diseases

TORSION OF THE TESTICLE *

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Torsion of the testicle has always been regarded as a condition which derives its main interest from its rarity. In the earlier days examples were reported only occasionally, and then one at a time. Nowadays, far more cases are reported, and each author reports a number; for instance, the most recent communication contains nine.[1] Are we to infer that a rare disease has become more frequent? Or, is it that fewer cases are overlooked and more are recognized? There is no doubt that the latter is the correct explanation.[2] Further, study of the modern cases shows for what they can be mistaken; and, if the older literature is examined in the light of this knowledge, cases will be discovered recorded under such diagnoses as hæmorrhagic infarction of the testicle, acute thrombosis of the vessels of the spermatic cord, spontaneous necrosis of the testicle, gangrene of the testicle after hæmatocele, orchitis in misplaced testicles, acute hydrocele in imperfectly descended testicles, etc. Time after time the industry of the various authors has resulted in the collection and recollection of the previously reported cases until their papers contain little more than repetitions of what has been said already by others. Whenever a literature has reached such a state it becomes imperative for someone to examine and digest this mass of work from a clinical and a pathological point of view.

* A post-graduate lecture delivered at the Hospital for Sick Children, Great Ormond Street, London.

[1] H. M. Rigby and R. J. Howard, "Torsion of the Testicle," *Lancet*, May 25th, 1907.

[2] Compare the history of "Torsion of the Omentum," by E. M. Corner and H. I. Pinches, *Am. Journ. Med. Science*, cxxx, pp. 314–329.

This attempt was begun in 1901, and has been continued as new works have been published. Several cases of acute and many cases of sub-acute torsion have passed under my own observation. Suffice it to say that more than one hundred cases are now published, and that both clinically and pathologically these present very various pictures: so much so, that we must recognize cases of acute torsion, subacute torsion, and chronic torsion of the testicle; a great advance on our previous knowledge.[3]

First, a few statistics are given from these cases. The youngest example was found in a baby fourteen days old, and the oldest, a rather doubtful case, was found in a man between 75 and 80 years of age. Twenty per cent. of the cases occurred within the first decade of life, forty-seven per cent. during the second decade of life, twenty per cent. in the third decade of life, ten per cent. in the fourth decade, two per cent. in the fifth decade, and one per cent. later. The figures show very clearly that the majority of the cases occur about or shortly after the changes in the testicle and spermatic cord which take place with the onset of puberty. Therefore these changes are factors in its production.

The testicle on the right side suffered more frequently than that on the left in the proportion of about 3 and 2, the relative percentages being about 60 and 40. No case of simultaneous bilateral torsion has been recorded. In about sixty-six per cent., two-thirds of the cases, the testicle was definitely imperfectly descended. In the remainder, thirty-four per cent., it is either definitely stated or implied to have been fully descended. These figures are in fact of little value because, from study of the descriptions of the thirty-four per cent. in which the testicle is said or implied to have been fully descended, it is obvious that some developmental defects, such as a long mesorchium, great movability, etc., were present.[4] So that an examination of the available cases makes it certain that some developmental defect is present in a much greater proportion than the figure sixty-six per cent. represents. This defect need not be obvious imperfect descent. In fact, torsion of the testicles would seem to be very rare apart from such a deficiency. Turning to the pathology, it

[3] Diseases of the Male Generative Organs. *Oxford Medical Press*, pp. 106-122.

[4] E. M. Corner, "The Movable Testicle," *Clinical Journal*, 1905, pp. 218–224.

is certain that examples have as complex and various a pathology as they present clinical pictures. It would seem that first of all they must be divided into two classes: *A.* when the torsion is in the spermatic cord just above the epididymis; and *B.* when the torsion occurs in the mesorchium, between the testicle and the epididymis. The fact that many authors have not recognized this distinction has caused much confusion and rendered the elucidation of certain points difficult or impossible. Occasionally, these two structures are twisted at the same time. For purposes of clearness each will be considered separately.

A. Torsion of the spermatic cord in these cases, begins in the cord just above the testicle. The average number of twists was about two, but varied from half a turn to four or five. There is no doubt that there has been a marked tendency for observers to overstate the number of twists. Mr. Russell Howard, of London, concurs in this opinion, which both of us have arrived at from a careful study of specimens and illustrations of specimens. The direction of the twist is impossible to state, owing to the tremendous confusion of terms which exists. As a probability it may be suggested that the twists on each side are in different directions: that on the right would appear to be as in withdrawing a corkscrew, counter-clockwise; that on the left would appear to be as when inserting a corkscrew, and with the hands of a watch held with its back to the abdomen, clockwise. The directions of the twist are precisely opposite on the two sides. In these cases, it is common to get a history extending over some time, even years, of attacks of pain, particularly after some exertion when it is usual to find multiple twists. It must not be supposed that the testicle suddenly spun round giddily like a top! The truth is that these multiple twists represent the summation of many little increments of torsion added from time to time; thus accounting for the clinical history of frequent attacks of pain. There are two sets of factors in the production of these twists, of which we are certain, disposing and causing, passive and active factors. Of the former, one is the very common presence of some developmental deficiency, often imperfect descent of the testicle; another being the vascular changes which occur in the gland and cord at the onset of puberty, as is indicated by the fact that the majority of examples of torsion

of the cord occurred about that age.[5] An active cause, muscular exertion, was found to be present in about fifty per cent. of the cases. In about eight per cent. the attack came on during sleep; in about twelve per cent. it was attributed to a blow of sorts; and in the remainder, thirty per cent., no adequate explanation was offered. However, by going into the history of the cases, there is no doubt of three things: First, the developmental defect; secondly, the changes of puberty; and thirdly, some muscular effort, which precipitated the onset of the final attack. Sometimes, thirty per cent. of the known cases, the onset occurred without any attributable cause; even when asleep in eight per cent. This does not forbid the action of some muscular effort; for instance, the effort may be so slight as to be unnoticed; a case has been recorded in which a man had an attack of pain whenever he crossed his legs in a peculiar way. This muscular force must be divided into two classes: one concerning movements of the legs, and the other, the raising of the abdominal pressure as in straining or lifting. In the first class the testicle is directly twisted; in the second, it is twisted indirectly by the spermatic cord as it is expelled from the abdomen by the effort. The first is like twisting a ball attached to a string; and the second is like twisting the string.

The cases, when the twist is above the epididymis, are characterized by the history of many previous attacks of pain followed by swelling, each attack leaving the organ more prone to subsequent ones.

B. When the twist is through the mesorchium, the fold of peritoneum connecting the testis and the epididymis, it can extend to the epididymis and even reach the cord above the testicle in chronic cases. But, as a class, the cases are more acute than those above-mentioned in class *A*. They may give histories of former attacks, but they are less often found; and when they are, the attacks are usually shorter and sharper, in fact, they are isolated torsions which undo completely as the attack ceases and do not represent an increment in a case of multiple or compound torsion. In class *A* the torsion is compound; in class *B* it is simple. When the twist

[5] Corner and Pinches, "The Pathology of Cases of Torsion of the Omentum," *S. Thomas' Hospital Reports*, 1904, pp. 435–475.

is in the mesorchium, it is usually one twist only, or even only half a twist, which has produced the symptoms. These cases are associated with the condition which has been described as the movable or wandering testicle.[6] The twist is not associated so directly with the vascular changes of puberty as are those of class *A*. It is due possibly to the organ entering the external abdominal ring, and in doing so its long axis undergoes a half-twist to accommodate itself to the triangular shape of the opening in the tendon of the external oblique. When expelled from the inguinal canal it may receive such an increase of the twist as interferes with its spontaneous reduction when the organ is free in the scrotum. Thus, the examples of this class are like those of the former, in being associated with both a developmental defect and an effort, but are unlike in occurring generally before puberty and being acute rather than subacute or chronic.

There is no line of demarcation between these two classes, *A* and *B*. Sometimes the twist may extend from the mesorchium to the spermatic cord, and sometimes it is found through the epididymis.

This concludes sufficient of the pathogeny of these cases as it is desirable to include in this paper. Attention will now be directed to some of the various clinical aspects under which these cases present themselves, an example of each, previously unrecorded, being quoted in illustration. It is hoped that by giving a series of clinical pictures the types of case will be brought more familiarly to the mind of the reader.

ACUTE TORSION OF THE CORD

The first cases in which rotation of the spermatic cord or testicle was noticed were those in which the clinical picture resembled that of a strangulated hernia. An example of this, a case of my own, may be published. W. B., aged 26, was admitted to St. Thomas' Hospital on May 22, 1902, in the morning. He gave the following history: The right testicle had never been so low as the left and apparently was incompletely descended. Moreover, it used to go up to the body more. When eighteen years of age, he

[6] *Clinical Journal*, 1905, pp. 218–224.

had an attack of sharp pain in the testicle, and it was at this time that he noted that it was smaller than the left. This attack was treated with applications of ice and passed away after lasting a week, two days of which he was in bed. There was no cause to which he attributed the onset. After this he had had occasional sharp attacks of pain in the testicle which lasted only a short time, sometimes occurring during and after sexual excitement. On May 20th, two days before admission to this hospital, pain started again in the right testicle, accompanied by vomiting. The bowels were open last on the day previous, May 19th. A medical man was called in and attempted to reduce the swelling which had appeared in the groin. During the manipulations the patient heard a click, and the pain ceased instantly. He had relief for twelve hours, and then the pain came on again more severely and the swelling rapidly increased in size. The attending doctor again tried taxis, and this time failed to relieve the pain. There was no cause to which the onset of the attack could be assigned.

On admission the patient had a very tender and slightly inflamed hernia-like swelling in the right inguinal region and scrotum, which was fluctuating, irreducible, and yielded no impulse on coughing. The testicle was impalpable. Operation was decided on immediately, the case being diagnosed as one of strangulated hernia in a congenital sac, as the testicle could not be felt. When opened the sac was found to be full of brown fluid. The testicle was situated just about the external abdominal ring and lay with its epididymis to the outerside and behind, the cord having undergone two complete twists, counterclockwise in direction. The cord was drawn down, transfixed and ligatured with silk, and the testicle removed. The conjoined tendon was then sewn to Poupart's ligament with fine silkworm gut, the external oblique was united with the same material, as also the skin. The convalescence was uninterrupted, the wound healing by first intention.

The parts removed may be briefly described as follows: The testis was of a blue-black color, and on section seemed firmer than normal. The spermatic cord had four half twists, counterclockwise, *i.e.*, two complete twists just above the testicle, which were quite tight, leading to thrombosis of the veins in the cord, and, doubtless also, to that of the spermatic artery. There were

also some slight adhesions about the twists which were easily undone. The tissues of the tunica vaginalis and scrotum were very œdematous. The tunica vaginalis was greatly distended with old blood and formed a large swelling, which had extended to the groin.

This is an example of by far the majority of the recognized and reported cases. It illustrates:

1. The recurring attacks of pain which subsided.
2. The reduction of the last stage of the twist by taxis.
3. The recurrence of the twist, giving rise to thrombosis of the spermatic vessels.
4. Clinically in the repeated attacks, and pathologically in the complete twists, it can be recognized that the final strangulation represented the summation of a series of small twists.
5. The swelling in the groin had no impulse on coughing as the thrombosed cord tightly filled the inguinal canal. Hence the close likeness to a strangulated hernia.

SUBACUTE TORSION

The pathological changes that result from torsion of the cord may be so subacute as to present similarity to a painful irreducible hernia which probably contains omentum.

T. N., aged 15, was admitted to St. Thomas' Hospital on September 11, 1901. He had had a lump in his left groin all his life, and also an imperfectly descended testicle on that side. He had had four or five attacks of pain; similar to, but not so severe as, that which caused him to seek admission. Generally these attacks lasted two or three hours, and were unaccompanied by sickness. The first began six months ago, just after the onset of puberty. Two days previous to his admission, he went for a walk through the fields and, on returning, lay down on a sofa, when he noticed that the lump in the left groin had become tender and painful. He assigned no cause for the pain. On examination, in the left groin, was found a lump the size of a walnut which had increased in size since admission. The skin over it was slightly reddened, and the mass painful and tender. The left side of the scrotum was empty. The mass was irreducible and gave no impulse on coughing. Whilst walking about the ward the lump got larger and

harder, and he was suddenly seized with an attack of pain, after which it became very hard. Eleven days had elapsed before the operation.

A curved incision was made over the tumor, with its convexity upwards, and the skin reflected from over the mass to which it was adherent. The mass was situated between the external oblique tendon and the skin. The tunica vaginalis was very thick, and contained some brownish, bloody fluid. On its deep surface, it was adherent to the external oblique, and had to be dissected off it. The mass was continuous with one filling the inguinal canal. After being freed, an omental hernia was found in the upper part of a total congenital sac of peritoneum. The abdominal end was sewn up with fine silk and the inguinal canal closed in two layers with stout silkworm gut. Owing to the size of the tumor removed a large "dead space" was left in which blood and serum collected. This was evacuated on the seventh day after operation, but subsequently, becoming infected, it led to the formation of a stitch sinus.

The parts removed consisted of a mass, V-shaped in appearance, the abdominal end of which was filled with adherent omentum, and the opposite pole was occupied by a smallish testicle, dark and discolored. The tunica vaginalis, which was immensely thickened, had been adherent to both the skin and the external oblique. It had contained brown, bloody fluid. Between the two ends the mass was quite solid and presented a monilliform appearance, due to the spermatic cord having wrapped four or more times round and constricting it, the intervening portions being distended with blood.[7]

This case illustrates:

1. The onset of symptoms at puberty.
2. The subacute course of the symptoms.
3. The recurrent attacks of pain, about seven or eight in number, multiple twists being found.
4. The absence of an impulse on coughing on account of the external adhesions, giving it likeness to a strangulated omental hernia.

[7] Edred M. Corner, "Diseases of the Male Generative Organs" (Frowde & Hodder & Stoughton), Fig. 17, p. 116.

SUBACUTE TORSION OF THE CORD WITH HÆMORRHAGE INTO THE TESTICLE [8]

F. H. A., aged 14, was sent to me by Dr. Kenneth Lund, of South Kensington. Two months previously the right testicle had begun to swell. The pain was only slight, but the patient felt seedy for a time. The swelling subsided in twenty-four hours after the cessation of the pain. One month ago the swelling recurred with acute pain and vomiting which lasted one night. Since then there has always been pain in the gland, which has continued to increase in size slowly.

On examination the right testicle was much enlarged, extending from the spine of the pubes to the bottom of the scrotum. The left testicle was markedly imperfectly descended, as was also the right until the enlargement made it appear fully descended. The swelling was tender, and on the front and inner side presented an area of fluctuation which was found subsequently to be bloodclot. The cord itself was hard and tender as far as the external abdominal ring. Pressure over the inguinal canal gave rise to no pain.

The right testicle was removed, and when opened both the testis and epididymis were found infiltrated with blood, whilst between them was a large hæmorrhage.[9] The testicle on the left side was replaced in the abdomen, orchidocœlioplasty.[10]

CHRONIC TORSION—RECURRENT ATTACKS OF PAIN IN AN UNDESCENDED TESTICLE

G. F., aged 19, admitted to St. Thomas' Hospital May 26, 1902. Has only had the right testicle completely descended. The left lies over the inguinal canal and causes pain. He has had several slight attacks of pain, the most severe being about three years ago, and was accompanied by nausea, no vomiting, obliging him to give up work for a time. Prolonged standing always gives him a dull aching pain in the testicle. On May 29th, a curved incision was made over the tumor, and the skin reflected therefrom. The testicle lay over the inguinal canal between the skin and the exter-

[8] Published for the first time.

[9] Edred M. Corner, "Diseases of the Male Generative Organs" (Frowde & Hodder & Stoughton), Fig. 18, p. 118.

[10] *British Medical Journal*, June 4th, 1904.

nal oblique to which the tunica vaginalis was adherent through chronic inflammation. The epididymis lay to the outer side of the testis, which had taken one complete, but not tight, twist. The inguinal canal was opened up, and a small acquired hernial sac found at the top. As the testicle was considerably smaller than the right, and the boy had developed all the characters of a man, the organ was removed and the inguinal canal sewn up with fine salmon gut. After the operation the temperature never rose above normal, the wound healed by first intention and the stitches were removed on the eighth day. The boy was somewhat neurasthenic [11] for two or three months afterwards, fearing attacks of pain, but ultimately recovered completely.

This illustrates:

1. Onset dating from puberty.
2. Recurrent attacks of pain associated with torsion of the cord.
3. The consequent wasting of testis.
4. The associated developmental defect; in this case, imperfect descent.

REPEATED ATTACKS OF SUBACUTE TORSION, UNTWISTED AND LEADING TO ITS ATROPHY

Dr. Perry, of Birmingham, has recorded the case of a young man of 25 who had had many recurring attacks of pain in the testicle, which began when he was 11 years old and recurred every two or three months for fourteen years, when a more acute attack supervened which Dr. Perry untwisted. He has had several slight attacks since then, which he untwists himself. Dr. Perry says that the gland is definitely smaller than the other, but is not actually atrophied. Apparently it is in a normally descended testicle. Mr. Gifford Nash has described a similar case, of which two years later he reported the atrophy of the gland. These cases illustrate the effects of chronic torsion, the exacerbations being accompanied by subacute pain and relieved by untwisting the cord; and, finally, that in future, steps must be taken early in such cases to avoid the atrophy of the gland.

[11] Edred M. Corner, "Post-operative Neurasthenia," *International Clinics*, 1906, 15th Series, N., pp. 147–158; also *Clinical Journal*, 1906, Feb. 7th, pp. 262–267.

Cases of thrombosis of the cord and necrosis of the testicle have been recorded. In some the testicle atrophies. Further, torsion of the cord has been found to be at the bottom of cases of hydrocele or hæmatocele of imperfectly descended testicles. In some cases an abscess is formed in the scrotum and a necrotic testicle discharged. In conclusion, a case of subacute torsion will be described which was diagnosed as orchitis.

A boy, 2½ years of age, was admitted to the Hospital for Sick Children, Great Ormond Street, for swelling of the testicle in the right groin. The tunica vaginalis was distended with fluid, but not too tightly for an enlarged tender testicle to be felt within it. The testicle was imperfectly descended, and the mother had noticed its apparent disappearance on several occasions. The case had been diagnosed as orchitis in an imperfectly descended testicle. Feeling that the subacute torsion of the cord was much more likely, the case was taken to the theatre and operated on. The tunica vaginalis was found full of slightly hæmorrhagic fluid, the testicle was blue-black in color, and the mesorchium was twisted completely once, counterclockwise. The twist involved the tail of the epididymis. The testicle was removed. The wound healed by first intention.

Treatment.—In acute cases, operation should not be delayed. In far and away the majority it will be necessary to remove the testicle, as it has been injured beyond recovery and will only atrophy if sutured in the scrotum. In the subacute cases the twist can often be undone by turning the organ in the direction which gives the patient relief. But this must be regarded merely as a temporizing measure to be followed by further reduction of the torsion and suture of the testicle in the scrotum to avoid its recurrence. Sometimes it will be found necessary to remove the organ. In the chronic cases, operation should always be urged in the hope of saving the gland from future harm by suturing it in the scrotum. In fact, to put it shortly, to diagnose torsion of the testicle is paramount to advising operation.

(None of the Author's cases quoted at length have been reported before except in his book on the "Diseases of the Male Generative Organs," published by the Oxford Medical Press.)

IMPROVEMENT IN THE METHOD OF DETERMINING IF GONORRHŒAL INFECTION IS PRESENT IN AN INFLAMED PROSTATE OR SEMINAL VESICLE

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Briefly stated the method submitted in the following note is to create a chemical urethral discharge, and when it is well established to seal the meatus with collodion or adhesive plaster and then to massage the secretion from the prostate or vesicles into the inflamed canal where it is left until the patient urinates. Gonococci will proliferate if placed in this favorable environment and may be demonstrated in the subsequent discharge.

The importance of knowing whether or not a patient who has had gonorrhœa is free from infection, especially when he desires to marry, is so evident that it needs no emphasis. The difficulty and uncertainty that ordinarily attend the examinations before declaring these patients cured is equally well known to all who are called upon to express an opinion as to the infectiousness of the conditions. Nearly all authorities also agree that the prostate gland and the seminal vesicles are the most frequent sources of recurrent urethral discharges and reinfections. As foci of the dormant gonococcus they are therefore of prime importance, and in fact usually the keystone of the situation in the uncertain cases.

The urethral discharge and threads give a basis upon which to work in reaching a conclusion especially if a discharge is produced with nitrate of silver to increase the number of the gonococci present. The condition of the prostate and vesicles is not determined by this test nor can we safely trust a negative microscopic examination of the secretion expressed from them as the microörganism may be in such small numbers that they will elude a most careful search—the volume of the discharge being too great to allow a smear to be made of all of it. Cultures taken from it are troublesome and unreliable except in the hands of an expert in a well-equipped laboratory.

Palpation of the prostate and vesicles also affords great opportunity of making errors as considerable induration and enlargement may exist without gonococci, while a small, apparently normal, organ may contain them.

This maze of uncertainty about a condition with such far-reaching and sometimes disastrous results led me to try a plan of investigation which is both simple and easy and when properly carried out greatly enhances the value of the usual tests. The procedure proposed is to create an irritation of the entire urethral canal by injecting about one ounce of a ½ to a 2 per cent. solution of nitrate of silver with a soft catheter and a syringe attached, or some similar device for placing it in both the anterior and posterior urethra. A few bottles of beer the night before the test may augment its value by the irritation which usually follows. Three or four hours later when the secretion has become well established the patient should urinate and the meatus thoroughly dried and sealed with a small amount of collodion or a bit of zinc oxide adhesive plaster. The prostate and vesicles are now massaged and their secretion pressed into the inflamed urethra where it is left until the patient is forced to void his urine.

As is only too well known there is no better culture medium for the gonococcus than is the inflamed urethra. Naturally if the expressed secretion, which is prevented from escaping by the collodion at the meatus, contains gonococci they will proliferate when planted upon such fertile soil, even if they were more or less inactive before.

When the patient is compelled to urinate the collodion or adhesive plaster can be removed without much difficulty. This discharge is allowed to escape and the next which forms is collected and if negative other smears should be taken 12, 18 or 24 hours later and carefully stained for the gonococcus. If the patient cannot report at suitable times for obtaining the smears he should be shown how to make them and be provided with slides.

In applying the collodion to the meatus the lips should be pressed so that the mucous portion is slightly invaginated and the sides are in close apposition. Two or three coatings will usually be sufficient to keep it sealed. If however there is any difficulty the collodion may be applied over a small pleget of cotton which reinforces it and

makes it more secure. Only a slight burning from ether is felt if the collodion is used without the cotton but a little more is experienced when it is used with cotton and may be avoided by soaking the cotton in a 4 per cent. solution of cocaine and placing it over the meatus a few minutes before sealing it. A small strip of adhesive plaster will often prove satisfactory and prevent the escape of the secretion if firmly pressed over the meatus after it has been carefully dried.

The strength of the nitrate of silver to be used must be determined by the previous treatment of the urethra. If active measures have been used a stronger solution is necessary than is required when little treatment has been taken.

This plan of searching for the gonococcus has been tried a number of times and has proved its reliability each time, whether positive or negative. From a view of the literature I have not been able to find where it has been recommended previously. Its simplicity and harmlessness and the fact that it undoubtedly augments the value of the ordinary test make it worthy of trial.

Orthopaedics

CHRONIC JOINT DISEASE IN CHILDREN

CHRONIC POLYARTHRITIS WITH ENLARGEMENT OF THE GLANDS AND SOMETIMES OF THE SPLEEN (STILL'S DISEASE)

BY W. B. JOHNSTON, M.D.

Probably the most usual form of chronic joint disease in children seen in hospitals and in private practice is that due to tuberculosis. Syphilitic joints are not uncommon and gonorrhœal arthritis is sometimes seen. The specific fevers, scarlet fever, diphtheria, influenza, measles, typhoid and erysipelas may be complicated by inflammation of the joint usually transient but sometimes going on to a permanent thickening of the periarticular structures with adhesions and varying degrees of fixation. Local infections, such as empyema and otitis media, may also be complicated by similar joint involvement. Repeated attacks of acute articular rheumatism may eventually produce a chronic fibrous thickening about the joints, or the same fibrous thickening accompanied by endocarditis and subcutaneous fibroid nodules may appear insidiously without previous attacks of rheumatism. Rheumatoid arthritis, similar to that which is so common in adults, sometimes occurs in children.

The chronic polyarthritis associated with enlargement of the glands and sometimes of the spleen, first described by Still, is met with in England and is probably of fairly common occurrence in America. Dr. Still thinks it is most frequent among children living in damp, low lying houses. It is not altogether a disease of the very poor and is apparently not the direct result of inheritance. It usually begins before the second dentition. A slight stiffness of the knee, hip, ankle and wrist is slowly followed by a firm, fibrous, fusiform enlargement of that joint. At longer or shorter

intervals all the other joints, including the sterno-clavicular joint, the jaws and the cervical spine are similarly affected. The cervical spine may be involved early in the disease. There may or may not be early constitutional disturbances and the joints may or may not be very painful.

Occasionally the disease may, like acute inflammatory rheumatism, begin gradually with high fever and signs of active local inflammation. Fluid and pus may be found in the joints. The swelling is always periarticular. The ends of the bones are not increased in size and there are no exostoses. Bony grating does not occur. The superficial glands, and noticeably the epitrochlears, are always enlarged and hard. As the inflammation about the joints becomes active and again subsides, the glands increase and decrease in size. The edge of the spleen is often palpable. The temperature is usually elevated and there may be periods of apyrexia. Sweating is often profuse and associated with rises in temperature. The urine may contain albumin and casts. The heart is sometimes slightly enlarged and hæmic bruits are heard but there is never evidence of endocarditis.

The children are always pale and show a marked general arrest of physical development with, sometimes, a slight exophthalmus. The thyroid is, however, not enlarged. Muscular atrophy begins early and is very pronounced. Damp cold weather always increases the pain and stiffness of the joints.

The etiology of the disease is unknown. No microöganisms have, even by such well-known investigators as Poynton and Payne, ever been found in or near the affected joints. In the four post mortem examinations that have been made the joints showed an increased vascularity of the synovial membrane and of the articular ligaments. The cartilages were normal, or in the cases of long standing, were slightly worm-eaten in appearance with little pits into which fitted small pieces of synovial membrane. The joint capsule and the periarticular connective tissue were much thickened and there were fibrous adhesions. The superficial glands and the spleen were enlarged and firm, but otherwise normal. The pericardium was firmly and closely adherent to the heart and in one instance this tendency to serous inflammation was seen in the pleura. There were no evidences of endocarditis.

The most important point in the treatment of the disease is to remove the child to a dry climate or even to a dry house. It is of almost equal importance to keep the child up and moving about. Baking the joints in a hot air furnace seems to decrease the pain and stiffness; massage strengthens the atrophied muscles. Arsenic and iron are given as tonics. If treatment is begun early and persevered in the disease may be arrested and a permanent cure may be obtained. If the disease has been allowed to progress for several years treatment is of little help, and then eventually results a condition of hopeless deformity which is permanent.

Dr. Still's original description in 1896 was based upon a study of 22 cases in the Great Ormond Street Hospital for Sick Children, London, and he has since seen a dozen more from the Southern countries of England. Between 1897 and 1901 there were seven cases in the Hospital for Crippled and Deformed Children and in the Johns Hopkins Hospital in Baltimore. All the children came from Maryland or from the neighboring counties of Pennsylvania and all were children of people in very moderate circumstances. The situation and hygienic condition of their homes were, unfortunately, not investigated. The accompanying photographs taken at the Johns Hopkins Hospital very well illustrate the symmetrical action and characteristic form of the joint enlargement.

In the pictures of S. H., a little boy 4 years old from Baltimore (Figs. 1 and 2) the deformities are of one year's standing. The disease had begun with a painful enlargement of the hands and feet sufficiently acute to keep him in bed for three months. Within a year the knees, elbows and cervical spine had become involved and he was barely able to move. His temperature was subnormal. The spleen could be easily palpated and all the superficial glands, particularly those in the axilla, and the epitrochlears, were enlarged and hard. The heart was not enlarged but the pulse was very rapid. The urine contained albumin and casts, and there was a slight leucocytosis. The photograph does not show the enlargement of the ankles and of the big toes, but the knees are seen to be enlarged and there is a curious puffy swelling of the wrists and of the backs of the hands. The right thumb is also swollen and the atrophy of the upper arm and of the lower leg and the stiffness of the cervical spine are clearly

Fig. 1.

L. H. 4 years old. Duration of disease, one year.

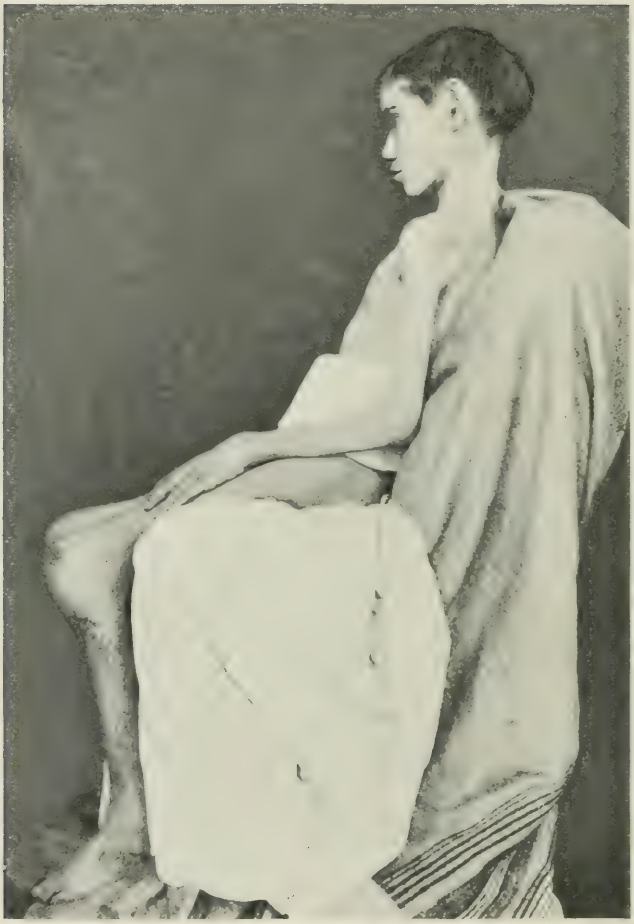
Fig. 2.

L. H. 4 years old. Duration of disease, one year.

Fig. 3.

L. H. 4½ years old. Six months after beginning treatment.

Fig. 4.



H. K. 13 years old. Duration of disease, 5 years.

shown. The swellings about the joints were smooth, fusiform and elastic. There was no reddening of the skin and no elevation of the surface temperature. The swelling of the wrists and hands was non-œdematous. No fluid could be made out but the carpal bones were loose. A tip of the finger could be inserted between them, they could be caught between the fingers, separated and rubbed upon each other. The bones were not enlarged and there was no bony grating. In some of the affected joints motion was greatly limited, but they were all extremely painful and sensitive to pressure. A radiograph of the right hand showed these bones to be normal in size and appearance. There was no evidence of tuberculosis. The child remained in the hospital six months. He was protected from dampness and exposure, and given small doses of iron and arsenic. Every other day the affected joints were baked for 20 minutes in a hot air furnace at 140° Cent., and joints and atrophied muscles were carefully massaged. When the second photograph was taken (Fig. 3) he was up and running about the ward. His color was good and he had gained several pounds. The swelling of the ankles, knees, and toes had disappeared, the atrophied muscles had increased in size and the knees were well covered with fat. There was still a slight puffiness of the backs of the hands and the cervical spine was stiff but the spleen could no longer be felt and all the swollen glands had either disappeared or greatly decreased in size. All trace of casts and albumin had disappeared from the urine.[1]

The picture of H. K. (Fig. 4), 13 years old, from York County, Pennsylvania, shows the deformities in an untreated case of 5 years' duration. The disease had begun with the sudden and acutely painful swelling of one knee. This soon subsided and, though the pain and stiffness never entirely disappeared, the boy was able to limp to and from school. Three years later the other knee became similarly involved and within the next two years the disease had attacked the feet, the hips, one wrist and several fingers,

[1] A little girl, 7 years old, described in *The Archives of Pediatrics*, November 1899 by Drs. Taylor and McKim of Baltimore was, after two years of treatment, cured and able to go to school. After two more years there had been no return of the disease. A detailed account of treatment is given in their paper.

the elbows, the cervical spine and the jaws. The involvement of the thumbs had begun with great pain, redness, and a rise in surface temperature. The involvement of the other joints, though painful, had not been so acute.

The boy was small for his age, thin and poorly developed but of fairly good color. General muscular atrophy was very marked. The lungs were normal but the heart was slightly enlarged and beating with an almost fœtal rhythm 140–160 times per minute. His temperature was 99°–100° and showed a slight evening elevation. The spleen and the superficial glands including the submaxillary glands were greatly enlarged. There was no leucocytosis and no albumin in the urine.

With the exception of the shoulder joints which were freely movable all the larger joints were fixed in the position shown in the picture. The rigidity of the cervical spine extended to the joints of the upper dorsal vertebræ. The jaws could only be separated 1 c.m. All the enlargements were of the characteristic growth, fusiform, elastic, periarticular nature. The bones were not enlarged and no bony grating could be made out. The boy suffered a great deal of pain and only remained a few days in the hospital. A year later his physician wrote that the muscular atrophy was now pronounced and the ankylosis of the joints now complete. The temperature was constantly raised to 101°. The pain was less severe and there had been no enlargement of the bones.

A condition practically identical with that of H. K. is seen in the first picture of G. P. (Fig 5), 15 years old, from Montgomery County, Maryland. The disease had begun suddenly in one hip. All the larger joints, many of the toes and fingers, the jaws, the sterno-clavicular joints and the costochondral articulations of the fourth and fifth ribs of one side were finally involved. All were acutely sensitive and all the swellings were smooth, fusiform and extra articular. The feet were very œdematous and the knees were distended with a purulent fluid. The legs, feet and right elbow were firmly ankylosed and the muscular atrophy was extreme. All the superficial glands were enlarged and the right epitrochlear gland above the rigid elbow was particularly large and hard. The spleen was palpable, 2 cm. below the costal margin. The heart was not enlarged but the pulse was very rapid, 120–140 beats per

Fig. 5.

L. P. 15 years old. Duration of disease, 5 years.

Fig. 6.

G. P. 18 years old. Duration of disease, 8 years.

Fig. 7.

G. P. 18 years old. Duration of disease, 8 years. The head of the left humerus has been forced upward out of its socket.

Fig. 8.

G. P. Right hand. Duration of disease, 9 years.

Fig. 9.

Left knee. Duration of disease, 9 years.

minute. The temperature was irregularly elevated and every night the feet sweated profusely. The urine contained a trace of albumin, but there was no leucocytosis. No microörganisms were found in the purulent fluid from the knee joint.

Practically nothing could be done for this boy. His joints were too sensitive for baking or massage and after three years, in which time he had gone to his home and again returned to a hospital, he had reached the distressing condition shown in the second photographs (Figs. 6 and 7). All the joints except the shoulders, fingers and toes were absolutely fixed. The head was twisted to one side and the jaws could separated just ½ cm.

The feet were still œdematous, but the fluid had disappeared from the knees. There were atrophic changes in the skin of the lower legs and feet. The ankylosis of the joints was plainly due to the gradual rigid contraction of the periarticular fibrous tissue. Careful measurement showed that the bones had not increased in size. There was no bony grating in the joints and the radiographs show the bones to be normal in appearance (Figs. 8 and 9). Some of the glands were smaller, others still large and hard. Owing to the awkward and immovable recumbent position and to the rigidity of the abdominal muscles the spleen could not be examined. The boy was never without fever either elevated at night or continuously elevated for several days. He is now 23 years old and the disease is stationary. After 13 years the only improvement has been in the gradual lessening of the pain. His mind is bright and active.

In no other disease of childhood is there seen this association of multiple symmetrical enlargement of the joints with general enlargement of the glands and of the spleen. When the disease begins insidiously in one joint it is at first difficult to distinguish it from tuberculosis. The tuberculin test is in these cases of doubtful importance and the general glandular enlargement, and the increase and decrease in the size of the glands accompanying the increase and decrease in the severity of symptoms must be relied on to make the diagnosis. When the onset is sudden with the simultaneous involvement of several joints it is very like acute articular rheumatism, but the enlargement of the glands, the absence of endocarditis and subcutaneous nodules, and the possible presence of pericarditis eventually distinguish it from

this disease.[2] Syphilitic and gonorrhœal joint inflammations are usually accompanied or preceded by evidences of specific infection, keratitis and iritis, vaginitis and ophthalmia neonatorum. In syphilis the bones are apt to be involved—when the joint enlargements follow the specific fevers and accompany local infection the relationship is usually evident. In acute rheumatoid arthritis the cartilages are eroded producing bony grating and the ends of the bones are regularly increased in size. There is no general enlargement of the glands.

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[2] G. P.'s younger sister, who also came under observation, had an attack of acute articular rheumatism followed by endocarditis from which she died. There had been no resulting chronic pain, stiffness or swelling of the joints and the glands and spleen were not enlarged.

RIGHT-ANGLED CONTRACTION OF THE TENDON ACHILLIS AS A CAUSE OF STUMBLING AND HALTING IN CHILDREN

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The condition which I am about to describe comes before us in different clinical guises, the apparent discrepancy being due to the degree of departure from the normal. I shall briefly indicate to you some of the phases which are met with.

A child is brought for advice by his parents with a statement that he very soon becomes tired in walking, has pains in his calves and round the knees. He is not able to run well nor swiftly. Shortly after starting he invariably stumbles and falls, and the scars about the upper part of the tibiæ and over the patellæ testify to the truth of this statement.

A second type of case is seen by the surgeon because the gait is shambling, and the child walks with short steps and the knees bent. He is found to be unable to take longer steps without bending the knees more. This child, too, is incapable of taking the same amount of walking and running exercise as his school-fellows.

A third variety of case is that in which a sprained ankle is constantly occurring.

A fourth class of case, and the most frequently met with, is the child who comes to us with so-called flat feet, these members being held in an everted position. Yet if you carefully observe the feet you note that, while there is undoubted eversion present, the arches have not fallen. The reverse is often the case, and the arch is exaggerated.

A fifth type is the child brought to see one in consultation because he turns his toes in and walks on the outer side of the foot.

Now all these different clinical states are referable to one underlying cause. In the normally constructed individual, if the knee is fully extended, and the important point is in the word

fully, the foot is capable of dorsiflexion, so as to make an angle of 72 degrees with the leg, that is 18 degrees less than the right angle. This fact can be readily verified by measurement with a goniometer. Now in the act of walking, at one particular moment it is essential that this power of complete dorsiflexion of the foot should be fully exercised. For example, when the step forward is being taken, presuming that the right leg is in advance, the left foot is at that moment firmly planted, toe and heel on the ground, bearing largely the weight of the body. In order to give the impetus to the stride, and at the same time to maintain the weight of the body, the left knee is fully extended, and the foot is dorsiflexed at the ankle to the extent of 18 degrees less than a right angle. If the angle of dorsiflexion be decreased the stride must be accordingly lessened, or the patient will be in uncertain equilibrium if he attempts to take a long step. The explanation of all the clinical phases I have described above is found in varying degrees of loss of the angle of dorsiflexion. It is due in these cases to some degree of contraction of the calf muscles and of the tendo-Achillis. Clinically we find that the usual condition is that the foot, with the knee fully extended, cannot be dorsiflexed beyond a right angle. Sometimes the condition is not so marked as this, there being 5 or even 10 degrees of dorsiflexion, but the fact remains that free movement of the ankle in the direction of flexion is limited, and it invariably produces definite results.

Thus in the first type of case brought to our notice the child becomes tired because his stride is habitually shortened, and the strain upon the calf muscles and tendo-Achillis accounts for the pain and weariness in those parts.

In the second type of case, the child with shambling gait, the explanation is quite obvious. If the calf-muscles and tendo-Achillis are too short, one of two things must result if rapid progression is desired. The child must either walk partly on his toes, with the heels slightly off the ground, or else bend the knees so as to relax the calf-muscles and tendons, and thus obtain full dorsiflexion at the ankle.

In the cases with frequently sprained ankles the explanation is that the habit of bending the knees in walking has not been learned, and at the particular moment in striding forward I have

indicated above, the foot is not planted firmly on the ground, but is in a condition of unstable equilibrium, so that if it rest on any inequality it is readily twisted inward or outward, and a sprain results.

In the fourth and fifth phases, the flat-footed child and the child walking with inverted feet, the mechanics are equally simple. The distance between the lower end of the femur and the heel can be shortened to accommodate the contracted structures in one of two ways, either by turning the foot outward or inward at the the ankle. In either case, in place of two parallel lines, composed of the lower end of the femur, the tibia, the astragalus and os calcis on the one hand; and the calf muscles and tendo-Achillis on the other hand, lying in the same vertical plane, a triangle is formed. The base of the triangle is the shortened muscles and tendon, the apex of the triangle is at the ankle. One side, made up of the bones above the ankle, is much longer than the other, composed of the bones below the ankle-joint.

This simple and seldom described condition of contraction may always be suspected if the heads of the metatarsal bones are found to be prominent in the soles of the feet, and is certainly present when a row of corns is seen over the projecting bones. In many cases, if allowed to proceed unchecked, the condition develops into ordinary talipes equinus about which no doubt can exist, but the object of these remarks is to insist upon the necessity of recognition, and the importance of treatment of these slighter degrees of contraction.

A word at this point as to the method of examination of the child. He should be seated, the knee fully extended, and the foot brought into a straight line with the leg. The foot should then be slowly dorsiflexed, and the moment resistance is encountered or pain is elicited passive movement should be stopped, and the angle taken by the goniometer.

Caution is necessary. No abrupt nor rough movement should be used in ascertaining the angle of dorsiflexion, or spasm will be set up in the calf muscles, and the degree of contraction will appear larger than it is. The passive movement of dorsiflexion of the foot should be slow, gentle and steady, and the child's attention distracted while it is being tested. The bones above and below the

ankle must be held in one right line. And it often happens that one examination is not sufficient to determine the degree of the trouble nor to decide what line of treatment should be adopted. If the child is cold, frightened or fatigued, the extent of loss of normal movement is often exaggerated. It is advisable in many cases to see the child on a second occasion, when it has had a night's rest, and when the parts are warm. These conditions may make a difference of 5 to 10 degrees in the estimation of the angle.

As to the cause of this right-angled contraction of the tendo-Achillis, it is found to be in many cases due to infantile paralysis, the incidence of which has fallen mainly upon the anterior muscles of the leg, which have all but recovered; in fact, by the ordinary tests they appear to have entirely recovered, but it is evident that the recovery is not quite complete, as there is a very slight loss of balance between the anterior and posterior muscles, which is shown by the dropping of the foot when it is lifted from the ground. If equilibrium be once disturbed the calf muscles gain a mechanical advantage and contracture follows. The difficulty of walking and the symptoms described to the surgeon frequently begin after an exanthem, such as whooping-cough or measles, which I venture to think are more often associated with neuritis of the nerve supply to the extensor muscles than is suspected.

Another set of causes is associated with throat lesions, such as tonsillitis of a doubtful nature and diphtheria. Or in Anglo-Indian children, I am frequently told that the child has suffered from one or two attacks of "fever."

The question of treatment is sometimes a difficult one. If the foot of the fully extended limb be incapable of dorsiflexion beyond a right angle, I am convinced that the proper thing to do is to lengthen the tendo-Achillis. This should not be done by simple section, as it is difficult to regulate the exact length of the band of new tissue between the severed ends of the tendon. It is extremely easy for the parts to heal with too long a union, so that talipes calcaneus results. Therefore I practice an open operation, in which the tendo-Achillis is lengthened to the requisite amount by the Z-shaped method. A transverse incision is made first half-way through the tendon, and then the knife is carried vertically downward for a distance of half to one inch. It is then turned

on the flat, and the remaining part of the tendon cut through transversely. The two portions are slid upon one another until the requisite degree of lengthening, which can only be learned by experience, is obtained, and then they are stitched together. (See Figs. 4 and 5.) In this way firm union is obtained and all risk of undue lengthening avoided. In those cases where there is only a small diminution of 5 degrees or so of the angle of dorsiflexion, an immediate operation is not to be advocated, but passive and active movements, designed to stretch the contracted structures, should be sedulously practiced; and much assistance is afforded by prescribing a surgical boot, with an outside steel to the calf and a toe-uplifting spring, the constant action of which stretches the shortened soft tissues. If this manœuvre fails we can always resort to the simple operation previously mentioned.

Fig. 1.

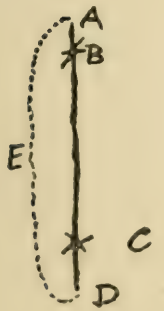


Fig. 2.

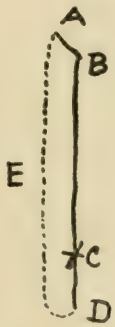
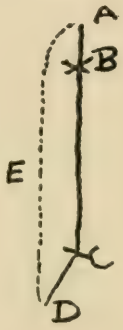


Fig. 3.



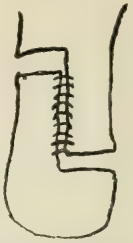
To show how the effort of compensating shortened calf muscles and tendo-Achillis, either by bending the knee, or by inversion or eversion of the ankle is effected. A = point of attachment of gastrocnemius at the lower end of the femur. B = knee-joint, C = ankle-joint. Between B and C = tibia and fibula, and C D = astragalus and os calcis. D = point of attachment of the calf muscles with the os calcis. E = dotted line *representing the calf muscles and tendo-Achillis.* In Fig 1 the structures are presumed to be normal. In Fig. 2 the calf muscles and tendo-Achillis are shortened, and the knee is bent so as to lessen the distance A–D between the lower end of the femur and the tuberosity of the os calcis, but the ankle is neither inverted nor everted. This

Figure is drawn in an antero-posterior plane. In Fig. 3 the calf muscles and tendo-Achillis being shortened, the knee is held straight, while the ankle is inverted or everted to lessen the distance A–D between the attachments of the calf muscles and their tendons. This Figure is drawn in a transverse plane.

Fig. 4.

Tendo-Achillis with Z-shaped section.

Fig. 5.



The two portions of the tendo-Achillis slid on each other to the required length and united by sutures.

A CASE OF TORTI-COLLIS, PROBABLY CONGENITAL

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Torti-collis, or wry-neck, of infancy, whether congenital or acquired, being of rather unusual occurrence, the following case is related as of some interest.

R. W., white, male, born November 2, 1906, was brought to the medical dispensary of the Children's Hospital of Philadelphia by his mother for treatment for wry-neck.

Family History.—Father healthy. Mother of a nervous temperament, but suffering from no disease; she has had no other children and no miscarriages. During the early period of pregnancy, she thinks about the third month, she had a fall, but, except for the severe jarring, she experienced no injury and suffered no untoward effects therefrom. During the last three months of pregnancy she complained of rheumatism, having what she described as general rheumatic pains, this condition was afebrile and her account of it is vague. The patient was born at full term and labor was easy, noninstrumental and normal in every respect, the head presenting and the child delivered without traction. At birth the child was immediately put in charge of the nurse, nothing abnormal about it being brought to the attention of the attending phyiscian. Three days later it was first noticed that the child "held its head crooked." The head was inclined towards the left shoulder with the face turned to the right and the eyes looking in the direction of the right shoulder. A phimosis was also noted at this time, but for neither condition was the family physician consulted. The infant was nursed at his mother's breast. The neck was rubbed in a desultory manner by the mother, but beyond this treatment nothing was done to rectify the condition. The deformity continued without change until the child was about two months of age. Up to this time he had appeared to be in good general health. At two months he suddenly developed a series of convulsions lasting

the greater part of one day then ceasing for one week; but at the end of that time he had one more. He has had none since. These convulsions were ascribed to the phimotic condition and the prepuce was stretched. From this time the wry-neck became more pronounced and finally, on February 25, 1907, he was brought to the dispensary. He was still on the breast and for the past few days had had some diarrhœa, without vomiting.

Examination.—Fairly well nourished infant, anterior fontanelle open, no evidence of rachitis. Has no teeth. No glandular enlargements noted. Lungs, heart and abdomen negative. Phimosis present. The child's head is inclined markedly to the left, being depressed on the left shoulder, the face is turned to the right with the eyes looking in a direction over the right deltoid region. There is no rotary or nodding spasm and no nystagmus. No facial asymmetry present. By fixing the left shoulder the head can, by using moderate force, be raised slightly from this inclined position but cannot be moved upwards to the median line. This procedure reveals a crease or erosion of the skin running transversely across the neck where the skin has been folded on itself by the unnatural position of the head. There is no induration of the sterno-cleido-mastoid nor any tumor of that muscle. The muscle appears tense but is not hypertrophied. There is no sign of tenderness about the neck, but the forced movement seems to cause some slight pain. A dusting powder was given for the neck which is to be regularly massaged by the mother with hot water. The child's temperature is 101° F. by rectum. Weight 13¼ pounds. Ordered Sodii Salycil gr. ii. t. i. d. (Fig. 1.)

On February 26th, 27th and 28th it was noted that the condition of the bowels had improved, the temperature keeping in the neighborhood of 100° by rectum. The condition of the head was very slightly improved, being in a small degree more movable than at the first visit. The mother's breast milk being scanty a modified milk mixture was ordered to alternate with the former. On February 28th the sodium salicylate was discontinued and a hot salt bag was ordered to be wedged between the left shoulder and that side of the head when the child was in bed. The massage was continued.

On March 1st the first decided improvement was noted, the

FIG. I.

Photograph showing marked inclination of head to the left.

FIG. II.

Photograph showing position of head after recovery.

general condition was much better and the head held much more towards the vertical plane of the body. The muscles of the left side of the neck were less tense. From this time on the improvement became more decided though not continuous. The erosion of the skin of the left side of the neck disappeared. The child at times holding its head almost in the erect position. At this time the child was circumcised.

On March 27th an intestinal disturbance arose which caused a relapse with a return of the deformity, but it was not so marked as when the child was first seen. This relapse was accompanied by a spasmus rotans of a mild type. There was no nystagmus. At the end of a week the patient had recovered from this relapse and the spasmus rotans had disappeared. The child could now turn its head freely from side to side, but could not depress his chin towards the right clavicle. Dr. Jopson saw the patient and considered the remaining disability due to a contraction of the left trapezius muscle. As the major part of the deformity had disappeared he advised no operative interference. The improvement continued, the head being held erect almost continually, and at one time the patient was brought with his head inclined towards the right shoulder, this lasted only for a day and was probably an affectation. From April 3rd, for a period of two weeks, the child was given Tr. Belladonna m. i., t. i. d. He was then taken to the country. He returned early in June with no trace of the torti-collis. (Fig. 2.)

The above single case is considered worth reporting, as it is the first that has been noted in this dispensary in the past 3 years. Whitman [1] states that of 507 cases of torti-collis, compared with 5,000 cases of congenital and acquired talipes treated in the Hospital for Ruptured and Crippled in New York, only 87 were of the congenital variety.

The etiology of this condition was the subject of a more abundant literature a decade ago than it has apparently been in the past few years. Stromeyer's [2] theory, which held that the congenital variety of torti-collis was due to a hæmatoma of the sterno-mastoid muscle with subsequent induration and contraction and that this hæmatoma was caused by some injury at birth, is now being abandoned by many observers. Some writers have considered

the induration to be of syphilitic origin. Wilkes,[3] as early as 1863, reported 3 cases of sterno-mastoid induration, 1 of which he considered had been present in uterine life. In none of these cases was there torti-collis present. Paget[4] reported 2 similar cases in the same year. Taylor[5] reported an autopsy on a child 6 weeks old with a congenital tumor of the sterno-mastoid which he thought had been present in utero. Golding Bird[6] in 1890 denied that the condition was due to hæmatoma either caused by injury at birth or present in utero, but believed that the deformity was analagous to the equino-varus which follows polio-myelitis, the primary lesion being a polio-encephalitis. He stated that the deformity was invariably right sided and always accompanied by facial asymmetry. Murray[7] agreed with Golding Bird inasmuch as he believed that the condition was analagous to talipes-equino-varus, but that it resembled only those cases that were due to a fixed position of the fœtus in utero. He also considered that the deformity was always right-sided and accompanied by facial asymmetry. D'Arcy Power[8] in relation to Stromeyer's theory that congenital torticollis is due without exception to hæmatoma of the sterno-mastoid muscle, says that "this opinion is too catholic, but on the other hand it is equally incorrect to assert that it is never caused by direct injury to the muscle." He exhibited a sterno-mastoid muscle removed at autopsy from a child of one month of age which showed a fibrous tumor which he believed was subsequent to a hæmorrhage into that muscle during intra-uterine life. He stated that in England, Clutton, Owens and himself had actually traced out cases of hæmatoma of the sterno-mastoid from early infancy to the time when they required tenotomy for wry-neck.

Whitman,[9] in 1891, in an article in the *Medical News,* made the following statement: "The causes of congenital wry-neck operate in a majority of cases before birth rather than during delivery." In the last edition of his work on Orthopædic Surgery he expresses the same opinion. He believes that lateral fixation of the head in utero is the etiological factor and, that as injury to a muscle in other regions is not followed by contraction he denies the probability of its occurrence in the sterno-mastoid. Alvarez,[10] in this connection, of hæmatoma of the sterno-mastoid, says that "at first there is no functional trouble, but later, . . . at about one month of age,

this lesion of the new born may cause torti-collis of the side affected." Richardson [11] states that there is always a myositis interstitialis present; he thinks that the torti-collis is due to a myositis the cause of which is in doubt. He doubts that lateral fixation of the head in utero is causal.

There are a number of cases on record in which heredity has been a striking phenomenon, such as the case reported by Fisher, cited by Nove-Josserand & Viannay,[12] of a woman with wry-neck who gave birth successively to seven wry-neck children. In relation to hæmatoma of the sterno-mastoid in cases of congenital torti-collis, these authors (N., J. & V.), state that microscopical examination of the indurated muscle has always failed to show traces of hæmorrhage or of blood pigment in the tissues. They quote the experiments of Witzel who failed to produce torti-collis in animals by injuring the sterno-mastoid; these animals being subsequently killed there was no trace of the wounds found in the latter muscles. In the case reported by them of a unilateral torti-collis with numerous other congenital deformities, there was present a myositis interstitialis of both sterno-mastoids. After performing a series of experiments on fœtal and new born cadavers consisting of injecting the vessels and at the same time forcibly putting the head in various degrees of tortion, they came to the conclusion that an ischæmia of the sterno-mastoid played an important rôle in the etiology of congenital torti-collis.

In view of the opinions quoted the case herewith reported seems to have the following points of interest. In the early period of pregnancy the mother sustained a fall, at delivery there was, although she was a primipara, no difficulty in labor, there was never any evidence of induration or hæmatoma of the sterno-mastoid, there was no facial asymmetry and the head was inclined to the left, instead of to the right, side. The conclusion drawn being that the deformity was due, most probably to a lateral fixation of the head in the pelvis during intra-uterine life.

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Neurology

OCCUPATION NEUROSIS; PAIN, RATHER THAN CRAMP, THE PROMINENT SYMPTOM OF THIS DISORDER

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This disorder is one with the various phases of which every practitioner should be familiar. The proposition is by no means so simple as is generally thought. The term "writer's cramp" has done much to mislead the practitioner, by calling attention to one symptom (*i.e.*, the cramp), a symptom neither the most prominent nor the most troublesome, in the occupation neuroses other than that produced by writing. Even in that form of occupation neurosis which results from too much writing, the cramp is not always more troublesome than the pain. Aside from writer's cramp, pain is the most prominent, and often the only symptom. Tenderness, weakness, and paræsthesia also appear, and cramp is sometimes present. In other words, the form recognized by Gowers as the "neuralgic" is the most common.

The pain, early in the appearance of the affection, is brought on only by making the occupation movements, and is not invariably produced even then. If the occupation be continued, every repetition of the act causes pain. By this time, perhaps, the pain is produced by other movements besides those of the occupation, and finally, spontaneous and paroxysmal pain is apt to appear in the same region, not generally following the exact track of any nerve but rather distributed over the area involved in the muscular action, perhaps radiating therefrom. Tenderness may or may not be present. Weakness, numbness, and prickling may appear. Wasting of muscles may follow, or other local signs due to overuse of the parts, but these symptoms are not strictly included under the term

"neurosis." The degree of work needed to produce the symptoms varies greatly, the neurotic individual offering the least resistance. In special forms, particularly that accompanied by numbness, the excessive use of tobacco doubtless favors the onset.

A medical practitioner consulted me recently for a pain in the left side of the neck and behind the ear. The pain was paroxysmal; when present it was accompanied by tenderness. The pain was so severe and so frequent as to force him to discontinue work. He had worked hard for 25 years, with practically no vacation. The branch to which he devoted special attention was that of diseases of the naso-pharynx, upon which region he did a great deal of operating. The pain came on when his head was placed in the position of operating, became rapidly unbearable if the posture was maintained, and persisted after its discontinuance. Attempts to read often brought on the pain.

The condition had naturally given rise to much solicitude, and obvious relief of mind followed the opinion that the difficulty was an occupation neurosis. The following day he spent in and about Boston, and for 36 hours was entirely free from pain, an experience which he had not had for some time. On the second day he was feeling so much better that he was tempted to return to his work, notwithstanding my advice for a prolonged abstinence from employment. He was desirous of visiting the hospital, and I there introduced him to the throat department, in which he was especially interested. Here he spent about an hour, watching operations, and examining throats. On sitting down to lunch afterwards, a violent paroxysm of pain appeared and lasted some time. It recurred during the evening upon taking up a paper and putting his head in the position of reading. This attack lasted several hours, during which the pain was intense and was accompanied by tenderness behind the ear.

This is a typical example of occupation neurosis. No drugs or other treatment will have the least effect upon it; massage is likely to make it worse. The only resource is absolute cessation of work for a prolonged period, certainly for several months, better for six months or a year. If a shorter rest does not cause the disappearance of the symptoms I should certainly advise such prolonged vacation. Since, however, the pain has not been of very

long duration, there is good reason to hope that even a month or two of rest will cause its disappearance, and that his work may then be renewed with caution.

Some years ago I myself acquired what is known as a "golf arm." At first certain swings of the club produced pain in the region of the insertion of the deltoid muscle; the exercise being continued, each motion of this sort produced the pain. Eventually not only this motion but others caused it, and finally it became spontaneous. A trial of vigorous massage increased the pain to so great a degree that relief was only found by using a sling, by the aid of which the symptom was reduced in the course of two weeks, to its former limits. I finally wrote to a friend in England and asked what they did when a golf player had acquired an arm of this variety. He replied that *golf players* did not acquire them, but when they appeared the arm was put in cotton batting for three months, during which time not a single motion resembling that of swinging the club was to be made. At the end of three months an attempt at this motion should be made; if it caused pain the arm was put up for another three months.

I did not suppose that my friend expected this advice to be taken quite literally, but I followed it faithfully, excepting as regards the cotton batting, and am satisfied that without this prolonged cessation from the movement I should have been experimenting with the treatment of the golf arm to-day.

Such cases as this introduce a new feature which complicates the problem, a feature which has doubtless done much to obscure the true nature of pure occupation neuroses.

This new feature is local or physical injury produced by excessive, or faulty, muscular effort.

The seat of disturbance in simple occupation neurosis is probably the cerebral cortex. The pain, as well as the spasm, doubtless represents rebellion on the part of the over-used cortical centres. (The term centre is used, not to indicate a single and isolated group of nerve cells, but to indicate the combined action of those cells which are brought to play, in a certain order, in making special movements.) That the injury does not lie in the individual cells is shown by the fact that these same cells may, in many cases, be called into play to make other movements of the same muscles.

Thus, the person who can no longer write may be able to sew without trouble, though in extreme cases, it is true, the pain may finally follow other movements besides those originally at fault.

The case of the laryngologist, whose case I have cited, was doubtless one of pure occupation neurosis,—the case of the golf player (or pseudo golf player) was doubtless complicated by local injury, perhaps the stretching of a tendon at its point of insertion, or some allied physical lesion. In neither case need we have recourse to the popular diagnosis "neuritis." Pain alone, in the absence of numbness, paralysis, tenderness or diminution of reflexes, does not establish neuritis.

In the neurosis of the laryngologist, upon whom the diagnosis of neuritis had been made, various local treatments (irritation, massage, electricity) had been resorted to without avail, and naturally, since the trouble was doubtless a pure occupation neurosis with disturbance limited to the cortex of the brain, though the symptoms were referred to a peripheral region. In the case of the golf arm, the only successful treatment was rest of the part, at first, for a week or two, absolute in a sling, afterwards, for a number of months, absolute as far as abstinence from golf was concerned.

The following is another illustration of a pure occupation neurosis:

Case I.—A lady of 41 consulted me, seven years ago, for persistent pain in the arm. The symptom had been gradually coming on for several years and steadily increasing. The diagnosis neuritis had been made, although neither loss of power, wasting or tenderness had appeared, and no numbness beyond occasional prickling in the hands such as is not infrequently present in occupation neurosis, that is, paræsthesia, not anæsthesia. Physical examination was negative. Treatment had been unavailing. The patient was rather reticent regarding her work and denied continued overuse of any special group of muscles. Her husband, however, stated that she had distressed the family by excessive use of the needle, a statement indignantly denied by the patient, who adduced as an argument the fact that she only took short stitches! On further inquiry she acknowledged that the cause of the short stitches was the extreme pain produced by long ones.

The treatment for this case consisted merely in enforced abstinence from sewing for three months, after which the movement of sewing was to be tried, but discontinued for a like period if the attempt reproduced the pain.

I have received no reply to my request for news regarding her present condition.

In contrast to this case of pure occupation neurosis, I will cite the following case in which muscular atrophy, produced by overuse, complicates the picture:

Case II.—A music teacher consulted me 16 years ago for pain and weakenss in the right upper extremity. She had strained the right little and ring fingers in practising a trill some time previous, but within a few months had recovered use of these fingers except that they became easily tired. She had had excessive pain in the right arm for a year. This pain had begun after an attack of pneumonia. It had gradually lessened. The sensitiveness prevented her wearing a heavy, or tight gown. Very little practising produced pain. There was a prickling sensation (paræsthesia) in the wrist and little and ring fingers, extending up the ulnar side of the arm. This numbness caused objects to feel unnatural but did not produce anæsthesia. She had always practised a great deal, at least six hours a day. I did not see her again until three years ago, when physical examination showed all movements of the arm normal, and the joints free, but there was marked wasting of the thenar muscles on the right and difficulty in flexing the thumb, as well as in opposing it to the little finger. There was also weakness of the interossei, without wasting. There was no objective anæsthesia. At that time there was also pain in the left hand with weakness of the thenar muscles. There was no fibrillary twitching in either hand. She was still using the left hand in teaching, but did not attempt to play pieces. At this time there was no special tenderness, and no numbness. There was a tendency to cramp in the right hand when she attempted to write. In other words, the right hand, since discontinuing attempts to use it at the piano, had remained practically in the same condition, while the left hand, which she had used more or less, had become worse.

In this case, added to the element of occupation neurosis, we have a variety of wasting not infrequent in overused muscles.

There was no fibrillary twitching, and I did not apprehend that the case would extend like the typical one of progressive muscular atrophy, and it has not done so. This case was complicated, then, by infective neuritis, and by muscular atrophy.

In the following case, which seems to me a pure occupation neurosis, pain was the sole symptom.

Case III.—A man of 44 complained of pain in the left forearm, of five years duration. It was always brought on by a certain movement, namely, that of carrying garments hung over his left arm. For many years his duties had obliged him continually to carry clothing in this way. Physical examination was absolutely negative, and prolonged rest from his employment the only treatment recommended.

In the following case, also doubtless a pure occupation neurosis, *loss of power* was the prominent symptom, though pain also appeared.

Case IV.—This was the case of a flute player, 28 years old. He had played the flute ten years. Three years previously he changed his method of playing, and began to notice that his lip tired easily. The chief complaint was that the lower lip became easily tired, and he found it impossible properly to hold the note. There was no cramp, and ordinarily no pain, but sometimes after much playing the lip ached. The trouble had been increasing during the past year and he felt that he would be unable to do his work if he were called on for anything important. Physical examination showed all the movements of the lip perfect; there was no tremor or twitching.

It will be noted that in only one of the cases cited has cramp appeared, and in this case it was not a prominent symptom. This absence of cramp I find in a dozen successive cases of occupation neurosis other than writer's cramp.

Case V.—To illustrate the fact that cramp does sometimes appear in such cases, I find the case of a young violin player whose chief complaint was the stiffening of the muscles of the arm on attempts to play; she also complained of pain on putting the arms in the position of playing. The physical examination was absolutely negative. There was no wasting, no anæsthesia and no disturbance of electrical reactions. The strength was good.

In the following case absolute immobilization was necessary:

Case VI.—A lady of about 30 noticed, a month before I was consulted, a fine tremor in all the fingers of the right hand. This was brought on by writing. Two days before pain had appeared in the thumb and in the first finger, extending up the forearm. A numb prickly feeling appeared at night. She had been carrying a heavy music roll in the right arm for half a day, twice a week, she sewed a great deal, sometimes the whole evening without stopping, she also practised a great deal upon the piano. She also drove a hard-pulling horse. In fact, there was almost constant use, and frequently over-use, of the hand. The movements which caused her the most pain were, in order, those of practising, of sewing and of writing. Her right hand had been growing worse for some months.

Physical examination showed a slight suggestion of fulness between the metacarpals and on the inside of the forearm, but the skin was normal and the fulness appeared to be only that of unusually well developed muscles. There was moderate tenderness of the whole forearm, not in the course of special nerves. All movements were made with good strength, but the right hand was jerky, and certain movements in writing produced cramp. The diagnosis occupation neurosis was made, and rest from use of the hand and arm for several months prescribed. No improvement appearing in the course of a few weeks, a splint was applied and the arm placed in a sling for several weeks. Under this absolute rest, improvement soon appeared and complete recovery followed. She can now use the hand perfectly for all these occupations, but has learned to keep the use within reasonable limits.

It seems important to cite also the following cases to emphasize the importance of inquiring into the occupation in cases of obscure complaints regarding the hands and arms. The diagnosis in these cases was not occupation neurosis, and the cause of the symptoms was peripheral rather than central.

Case VII.—A ticket agent was brought to the neurological department, from the surgical department, of the Massachusetts General Hospital for persistent pain and tenderness on the radial side of the first phalanx of the ring finger of the right hand. Examination from the surgical point of view had revealed nothing; the

neurological examination was also negative. I questioned him as to any source of pressure in his occupation upon this part, and he stated that there was none. The next day he returned to report that the first thing he noticed on returning to his occupation was that each time he stamped a ticket the corner of the ticket was pressed against the exact spot in his finger which had become sensitive and painful. He had become so accustomed to doing this that it had made no impression upon him until he was asked the question. A change in the manner of holding the tickets caused a speedy disappearance of the symptom.

Case VIII.—A gentleman whose work keeps him each day at his desk, complained of an annoying numbness involving the ulnar side of his hands and forearms. The pain had lasted for many months, was steadily increasing and had begun to cause alarm. He had consulted several physicians without relief. The diagnosis of neuritis had been made, but efforts at its treatment had proved of no avail.

Upon my asking him to illustrate how he used his arms at the desk, he rested both forearms on the edge of the desk, and said that he sat in that position much of the time. I advised him to discontinue this posture. He did so and within a short time the numbness entirely disappeared.

Case IX.—A travelling man complained of annoying and persistent numbness in the ulnar distribution of his right hand. After close questioning regarding the habitual movements of his arm, it seemed that his favorite attitude in the train involved the resting of the right elbow in a certain way upon the window seat. This position he would occupy for hours at a time.

Discontinuance of this habit caused prompt disappearance of the symptoms.

I recall the cases of two other gentlemen who complained, one of numbness, and the other of pain, in the ulnar distribution. Both realized, on questioning, that they were in the habit of sitting for hours in the easy chair holding their book in a certain position, the one resting his elbow in a definite way upon his chair-arm, the other holding the book with the arms free. In both these cases the question was complicated by the excessive use of tobacco. The symptoms speedily disappeared in the case of the gentleman who

rested the elbows upon the arms of the chair, upon leaving off this habit and upon lessening his tobacco. The other case proved more intractible, as is usually the case where pain, rather than numbness, is the prominent symptom. The case finally yielded, however, to prolonged disuse of tobacco, static electricity, carrying the arm in a sling and taking a long needed vacation.

In conclusion I would first emphasize the importance of inquiring minutely into the use of the parts in all obscure cases of pain, numbness, spasm and loss of power, particularly when the upper extremities are the seat of the trouble. Secondly, I would draw attention to the important part played by pain, and the comparatively unimportant part played by cramp in the occupation neuroses, other than writer's cramp. Thirdly, I would urge distinguishing carefully between the symptoms of local lesion and those of occupation neurosis, and of remembering that both may be present in a given case. Fourthly, I would insist upon the importance of prolonged rest, if necessary by the use of splint and sling.

DISORDERS OF SLEEP

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Most of us spend about one-third of our life in sleeping. But the physiology of sleep is not yet completely understood. Let us recall the chief phenomena of ordinary healthy sleep. First there is diminution and then loss of conscious recognition of ordinary stimuli, such as would ordinarily attract our attention, whether these stimuli be derived from the outer world or from within our own organism. There is also, as consciousness is becoming blunted, a characteristic and indescribable sense of well-being. Voluntary movements become languid and ultimately cease, and the muscles of the limbs relax. Meanwhile there develops a double ptosis or drooping of the eyelids; the respiratory movements become slower and deeper, the pulse is slowed, the cutaneous vessels dilate to a slight extent, and the general temperature of the body falls, whilst many processes of metabolism, such as those of digestion and of certain secretions, are retarded.

Various explanations have been offered to account for all these phenomena. But at the outset we should recognize that the process is a complex one, implicating many other organs besides the brain.

As regards the condition of the brain during natural sleep, it is generally admitted that it is anæmic. If we observe a patient or an animal that has been trephined, we see that during sleep the volume of the brain is diminished; it sinks in and becomes pale, *i.e.*, the cortical vessels are contracted. And this vaso-constriction is not confined to the superficial vessels alone; it implicates the whole cerebral circulation, for if we succeed in examining the patient's retinal vessels with an ophthalmoscope without wakening him, we find that they present a similar vaso-constriction. Cerebral anæmia, then, is one important factor in natural sleep. After a heavy meal we are all familiar with the difficulty of doing mental

work and the tendency to fall asleep. This is doubtless explained to some extent by the occurrence of temporary abdominal hyperæmia with compensatory cerebral anæmia.

Let us next consider the condition of the nerve-cells during sleep. The activity of certain cells, certainly that of the cortical cells, is temporarily diminished. Some observers have suggested that this is due to a retraction of the dendrites by a sort of amœboid movement, whereby nerve-cells previously in contact become, as it were, temporarily insulated. But the evidence in support of this theory is far from convincing. In fact, modern histological observation goes to show that nerve-cells are not merely in contact, but that neuro-fibrillæ are continuous from cell to cell throughout the nervous system.

Other writers ascribe the phenomena of sleep to a poisoning of the nerve-cells by accumulation of CO_2, or to intoxication by other waste products of metabolism acting as narcotics. Be this as it may, we must bear in mind, as Claparède [1] has urged, that neither CO_2 poisoning nor intoxication are necessary antecedents for sleep. On the contrary, we usually sleep for the purpose of avoiding auto-intoxication and of preventing exhaustion, not because auto-intoxication or exhaustion has supervened. Healthy sleep is not necessarily a poisoning of certain nerve centres by toxic by-products. Moreover, there is a regular periodicity whereby a healthy person, whether fatigued or not, has a recurrent appetite for sleep. Sleep has a constructive, anabolic, invigorating effect on the whole body. Part of this effect is doubtless due to physical rest, part perhaps to interruption in the production of toxins arising from muscular contraction, and part to the absence of stimuli which during waking hours excite nervous katabolism.

Some writers have assigned special importance to a particular region of the brain in connection with the function of sleep, and especially to the floor of the third ventricle and the sylvian aqueduct. In support of this, they point out the well-known ptosis and tendency to divergent strabismus, both of which might be explained as due to the paresis of the ocular nuclei. They also recall the well-established fact that tumors in this region of the brain are specially likely to have as an early symptom persistent

[1] "Archives de Biologie," 1905.

drowsiness. But some of these cases can also be explained as due to cerebral anæmia, the tumor at the base mechanically compressing and narrowing the arteries which form the circle of Willis. This has been demonstrated in several instances, notably in a case of tumor of the hypophysis recorded by Franceschi.[2] Some time ago I myself had under my care a similar case in a young woman aged 26, with a large cystic growth of the pituitary body and floor of the third ventricle, in whom the chief symptoms were paroxysms of overpowering sleep. She ultimately passed into a stuporose condition and died. No paralytic phenomena occurred during life, nor was there any optic neuritis.

Another item which helps in the production of natural sleep is the absence of violent external stimuli, such as loud sounds or dazzling light. Therefore silence and darkness, by withdrawal of stimuli, conduce to sleep. A pleasing monotony of gently reiterated stimuli often has a similar soothing effect, for example, the steady red glow of fire on a winter afternoon, or the restful tones of the preacher's voice in church. The effect of such stimuli is quite *sui generis* and closely analogous to the condition of hypnosis. It cannot be ascribed to cerebral anæmia, to exhaustion, or to any toxic action.

We recognize different degrees of normal sleep, according to the strength of stimulus necessary to rouse the sleeper to a consciousness of his surroundings. The lightest is that of mere drowsiness, a stage in which the sleeper, though not directing his conscious attention to surrounding objects, can still be easily wakened by moderate stimuli such as ordinary conversation, light touches, etc. A deeper stage is sleep with dreams, where the sleeper is unconscious of his surroundings, but yet his psychical centres, uncontrolled and deprived of the faculty of comparison with his environment, weave chains of fantastic mental pictures. Under the influence of dreams a sleeper may, if his cortical motor centres are still active whilst the psycho-sensory centres are uninhibited, perform motor actions, as in the well-known stage of sleep with somnambulism. But in health somnambulism is rare, because ordinarily the cortical motor centres are dulled simultaneously with the sensory. Still more profound is the stage of deep, dreamless sleep.

[2] "Rivista di patologia nervosa e mentale," 1900, p. 457.

This variety merges into what under pathological conditions we call stupor and ultimately coma. The chief distinguishing point between deep sleep and coma is that a sleeping person can be roused whilst a comatose patient cannot.

Disorders of Sleep.—We sometimes meet with *pathological drowsiness.* Perhaps the most common instance is that of an anæmic young woman. Here the drowsiness may be partly toxic, due to absorption of poisons, whether from a loaded intestine, from decaying teeth or from other sources, but the main element in causation is probably vascular. The heart is devoid of energy, and the vessels throughout the body are flabby and deficient in tone. Therefore in the erect attitude the vessels of the brain are badly filled, and if the patient sits down during the day she feels drowsy. But when she lies down at night, the brain now becomes hyperæmic from want of vascular tone, and the result is that she lies awake. This combination of diurnal drowsiness with nocturnal wakefulness is highly characteristic. In treating the condition, besides attacking the anæmia, we often administer digitalis, since, besides being a cardiac tonic, it has also a well-marked vaso-constrictor action. If digitalis be combined with iron and with bromide of potassium, the condition generally rapidly improves.

Drowsiness also occurs in other conditions. Myxœdematous patients are habitually sleepy and stupid, probably from toxæmia. So also are many idiots and cretins. After a severe fit it is not uncommon for the epileptic patient to fall into a deep sleep, largely due, no doubt, to toxic products produced by the nervous and muscular systems during the fit. Certain tumors of the brain, especially in the region of the floor of the third ventricle, as we have already seen, are associated with early and persistent drowsiness, so also are some cases of punctured wounds in the same region. Elsewhere in the brain, tumors may also produce drowsiness at a late stage of the disease, probably from increased intra-cranial pressure, though in these cases the condition more nearly approaches coma and ultimately merges into it. The drowsiness produced by the combination of exhaustion with extreme cold, as in people who are in danger of being frozen to death, is probably largely due to deficient circulation, and, unless vigorous measures be taken to stimulate the heart and the general circulation, sleep passes on to

coma and death. The delightful drowsiness produced by gazing into a red fire on a winter afternoon is something entirely different. It is probably a mild variety of hypnotic sleep, the continuous red glow acting through the optic nerves by a summation of stimuli. It is not a question of the mere heat of the fire, for, unless the blaze is seen, drowsiness is not so likely to supervene. A similar summation of stimuli probably explains the well-known church drowsiness. The soothing monotony of the preacher's voice, combined with the sitting posture of the listener (who thus has the additional excuse of a degree of cerebral anæmia), and, lastly, the common habit of closing the eyes to avoid visual distractions—all these combine to make church-drowsiness a popular disorder. I do not refer, of course, to wild revival meetings, nor to militant political speeches or sensational sermons, where the conditions both of preacher and of audience are entirely different.

But there are other pathological varities of sleep to which we must refer. There is the drowsiness of impending uræmic or diabetic coma, both toxic in origin. There is also that remarkable tropical disease, sleeping-sickness, endemic in certain parts of Africa and associated with the presence of trypanosomes in the blood, glands and cerebro-spinal fluid. The drowsiness of this disease is doubtless due to some toxin produced by the parasites. In the later stages of the disease a peri-vascular cellular infiltration is found around the cerebral vessels—a variety of chronic meningo-encephalitis. Narcolepsy is another condition where the patient suddenly falls asleep, in the midst of whatever occupation he may be pursuing at the moment. These cases are hysterical. I remember one such patient who used to fall asleep when playing the piano or during a game of cards (especially if he held a losing hand). He had numerous other hysterical stigmata, and the diagnosis presented no serious difficulty. The hypnotic state is another condition, analogous in some respects to ordinary sleep, but time does not allow us to discuss it here. Suffice it to say that the phenomena of hypnosis can be induced by repeated monotonous stimuli, visual, auditory or otherwise, aided by suggestion. The patient is thereby made to fall into a sleepy condition, varying in intensity from mere drowsiness to dreams (the incidents of which are controlled by suggestion), to somnambulism, or to deep dream-

less slumber lasting perhaps for many hours. There are also the well-known phenomena of spontaneous somnambulism, due to the remaining awake, as it were, of the cortical motor centres when the higher sensory and psychical centres have lost their power of inhibition. Such a patient gets up and acts his dream. Nightmares are horrifying dreams which produce so much distress that they sometimes waken the patient. They are generally toxic in origin. Their commonest cause is gastro-intestinal fermentation, certain articles of diet (proverbially a lobster supper), being specially liable to produce bad dreams. In children nightmares often recur again and again, with the peculiarity that the terrifying hallucination is the same on each occasion. Here, again, gastro-intestinal fermentation is often a factor. Still more frequently do we find that the child has adenoids, which interfere with respiration and produce a degree of CO_2 poisoning. Removal of adenoids and attention to the bowels cures most cases of night-terrors in children. Patients with tropical abscess of the liver, curiously enough, are particularly liable to horrible dreams, so much so that they may be afraid to go to sleep. Here, again, the condition is probably toxic. Nightmare is also a frequent symptom in patients with aortic regurgitation. In them the conditon is not toxic but vascular in origin, due to irregularity in the blood-supply and to pulsation in the cortical capillaries.

Let us consider the subject of *sleeplessness* or *insomnia*. Cases of insomnia may be divided into two great classes, the extrinsic and the intrinsic.

Extrinsic insomnia includes those cases where the sleeplessness is secondary to some outside cause, not directly associated with the cerebrum or its blood-vessels. For example, physical pain of any sort, cough, vomiting, frequent micturition, diarrhœa, pruritus, and so on, may keep a patient awake. In all such cases we must treat the primary symptom; when it is relieved, sleep will follow naturally. This group also includes emotional insomnia, which is more often the result of grief than of joy, and is more commonly associated with fear or apprehension for the future than with remorse or sorrow for the past. When pleasurable emotion does cause insomnia, it is generally due to anticipation of some happiness in the immediate future. The treatment of emotional insomnia,

apart from assuaging the patient's sorrow (a matter which is often beyond the physician's sphere), is best accomplished by giving some cerebral sedative, such as a mixture of chloral and potassium bromide. The insomnia of extreme joy seldom calls for treatment, but if the patient becomes too excited, here, again, a cerebral sedative may be given.

. We are much oftener consulted with regard to the other kind of insomnia, which we call *intrinsic insomnia.* This is commonly due to vascular, toxic, or nervous faults, or to combinations of all three.

As to *vascular* causes, the brain may be hyperæmic, rendering sleep impossible. Hyperæmic insomnia may be either of the high-tension or of the low-tension type. In high-tension insomnia, the patient may be the subject of general arterio sclerosis or of renal disease. In such cases the patient complains of a difficulty in falling off to sleep. The best remedy, as Broadbent [3] has long urged, is to give some mercurial aperient, such as blue pill or calomel, say two or three times a week. This often brings down the tension in a remarkable way and induces sleep. Of course we must also lay down careful regulations as to diet, etc., in these cases. Hyperæmic insomnia from low-tension occurs in anæmic and neurasthenic patients, as already explained, and is characterized by the fact that when the patient sits erect in a chair she becomes drowsy, whereas when she lies down in bed the brain becomes over-filled with blood and the patient cannot get to sleep. In such cases the best remedy is a combination of a cardio-vascular tonic, like digitalis, with a moderate dose of bromide of potassium. Hyperæmic insomnia, whether of high-tension or of low-tension type, is often associated with cold feet. If the feet can be made warm, the cerebral hyperæmia tends to become alleviated. Again, a cup of hot milk or hot soup, producing abdominal hyperæmia, often relieves hyperæmic insomnia.

Insomnia is one of the most distressing symptoms of chronic heart-failure. Just when dropping off to sleep the patient suddenly starts awake, with a feeling of suffocation, gasping for breath. This is probably due to deficient circulation in the medulla

[3] See "*Practitioner,*" July, 1906.

oblongata. We treat it by cardiac tonics, together with one of the non-depressant pure hypnotics, or even by morphine cautiously administered and combined with atropine.

Next, we have *toxic* insomnia, which is one of the commonest varieties met with in practice. Many cases are associated with gastric or intestinal fermentation, and especially with dilatation of the stomach. The symptoms are characteristic. The patient falls asleep, but, after an hour or two, varying according to the degree of gastric dilatation, he wakes up, perhaps after a horrible dream, with palpitation, profuse sweating or gastric uneasiness. He may have a sinking feeling with craving for food, and if he eats a biscuit or some other simple article, the stomach contents are temporarily diluted and he feels relieved for the time. This may mislead him into thinking that his sleeplessness is due to exhaustion from want of food. During his waking hours he is often very depressed and hypochondriac, and almost melancholic. When we have a clinical history of this sort, we should carefully examine the abdomen. If we find the physical signs of dilated stomach, we treat the patient accordingly, putting him on a dry dietary, free from starchy foods or green vegetables, and attending carefully to the bowels. We meanwhile administer gastro-intestinal antiseptics, such as carbolic acid, creosote, β-naphthol, or sulphocarbolate of soda. To give hypnotics in such cases, without correcting the gastric condition, is worse than useless.

Amongst the toxic forms of insomnia we must not omit to refer to the sleeplessness produced by chronic excess in alcohol, culminating sometimes in delirium tremens; also the insomnia of acute fevers. Both in fever and in delirium tremens sleep can often be induced by a cold pack or cold sponging. Insomnia may result sometimes from excessive tobacco-smoking, which produces its effect partly by its action on the nerve-cells, partly by its influence on the circulation. Strong tea or coffee may also act in a similar fashion, keeping a patient awake.

Lastly, there is *primary or "nervous" insomnia*, due to overfatigue, especially from mental overwork. We may see many cases amongst busy professional or business men. But in most cases there are several factors involved, not only the toxins of exhaustion, but those of hasty and ill-digested meals, together with

the succession of powerful mental stimuli and the persistent cerebral hyperæmia of the brain-worker.

In all primary insomnias, besides correcting any gastric, intestinal or vascular fault that may be present, we should make it a golden rule to send the patient away for a complete holiday. These are also the cases for the employment of the pure hypnotics, which have a direct sedative action on the psycho-sensory cortex. The name of these drugs is legion, and I do not propose to discuss them exhaustively. Amongst the most reliable is paraldehyde. Its somewhat nauseous taste is no drawback, since it prevents the patient from acquiring a habit for the drug. Of the other hypnotics I need only mention a few, such as chloral hydrate, sulphonal and veronal. We should never give the patient " carte blanche " to take a hypnotic drug on his own initiative. Self-drugging with hypnotics is highly dangerous. A hypnotic should never be taken without the express authority of the physician. Nor should anyone, even though he be a medical man, prescribe hypnotics for himself; he should call in a professional colleague.

Drugs like hyoscine and morphine are our last resort in obstinate insomnia. In severe cases of excited mania or melancholia $^1/_{100}$ gr. of hyoscine, hypodermically, or $\frac{1}{3}$ gr. of morphine with $^1/_{100}$ gr. of atropine, soothe the patient in a remarkable way. Persistent insomnia in cases of insanity is of serious omen. Most alienist physicians insist on having charts kept of the amount of sleep obtained by each insane patient, since severe insomnia, recurring regularly for a month in cases of insanity, renders the prognosis as to recovery very unfavorable.

UNILATERAL HÆMORRHAGE IN THE MEDULLA, FOLLOWED BY SYRINGOMYELIC SENSORY DISTURBANCES (SYRINGOBULBIA)*

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The unusual features of the present case make it extremely interesting and instructive from the standpoint of diagnosis as to the seat and nature of the lesion. The peculiar association of symptoms places the case among the rarest. The history is as follows:

On July 24, 1907, G. Z., grocer, 48 years of age, returned from his work more tired than usual. Suddenly his vision began to fail and he felt that everything was turning towards the right. He then became unconscious and remained in this state an hour. Resuscitated he noticed that he was unable to swallow and expectorate, also was short of breath. The vertigo was pronounced.

An examination made three days later revealed the following condition: The head was inclined to the right. The face was drawn towards the left, the left naso-labial fold was deeper than the right, the right forehead wrinkled less on voluntary movements than left, the right palpebral fissure was narrower than left, the right pupil smaller than the left. There was also retraction of the eye ball. Palate was sagging, uvula almost immobile, tongue very tremulous and protruded toward the right. The patient also experienced some difficulty in moving the tongue to either side or in protruding it. The entire left side of the body, including face, forehead, and scalp, presented the syringomyelic sensory dissociation, *viz.*, absolute loss of sense of pain and temperature with some preservation of the sense of touch. The deglutition was impossible, so that the patient had to be fed by high rectal nutritive enemata. Expectoration was impossible.

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* Read and patient exhibited before the Philadelphia Neurological Society, October 22, 1907.

The gait was very interesting. He could not walk along a straight line, but walked in zigzag inclining more towards the right than to the left; he also showed a tendency to fall to the right. There was a marked cerebellar asynergy, *viz.,* while the legs advanced in walking, the trunk did not follow. At that time the patient complained of severe pain in the neck. Bleeding by means of leeches applied to the neck relieved the pain considerably, but the above symptoms remained unchanged for a period of three weeks during which time he had on several occasions a rise of temperature with exacerbation of pain. Iodides were given internally in gradually increasing doses. On the fourth week some improvement began to appear in the act of swallowing. Now and then he would swallow small quantities of fluid. The gait began to improve, but he still held the head inclined towards the right shoulder. The sensory disturbances remained the same. Three weeks later he was able to swallow still better, and the gait became entirely normal.

The present condition is as follows: The gait and station are normal. The reflexes of the lower extremities are exaggerated. The face is slightly drawn to the left. The right palpebral fissure is narrow, the right pupil small and the eyeball retracted. The swallowing is somewhat difficult. Particles of solid food remain on the right side of his throat and he is obliged to use liquids to wash them down. Occasionally he suffers from shortness of breath. In the posterior right pillar of the tonsil and in the right arytenoid is seen a marked sluggishness and incompleteness of action. The uvula is pulled to the left on muscular contraction. The vocal cords are slightly engorged. The tongue is flabby, presents RD and a fibrillary tremor is very marked. The entire left side of the body including the face, forehead, and scalp presents a total loss of pain and temperature senses with preservation of the sense of touch. The patient complains of stiffness of the jaws especially noticeable in attempts to yawn or in the act of masticating. At times he has sharp pain in the upper part of his neck. He also complains of a continuous burning sensation in the left arm and legs and in the left side of the trunk, while objectively the skin on the same side is colder than over the right side.

Comment.—The zigzag gait with the tendency to fall towards

the right, the position of the head, the typical asynergia—all these symptoms point to a cerebellar condition or to an involvement of one of the cerebellar peduncles on the right side. On the other hand the facial palsy, the inability to swallow and expectorate, the inability at first to move the tongue, and later its atrophy with RD, also the marked fibrillary tremor of the latter point to an involvement of the right seventh, ninth, tenth, and twelfth cranial nerves or of their respective nuclei.

The loss, at first almost complete, of all forms of sensation later only of the sense of pain and temperature on the entire left side including the left half of the face and scalp—point to an involvement in the right side of medulla of the fibres of the median fillet. As the tactile fibres are preserved and only pain and temperature tracts are now affected, it is to be supposed that Gowers' bundle in its bulbar passage was invaded.

With the exception of the sensory disturbance all the other symptoms point clearly to a right sided involvement of the medulla and the lesion whatever it may be affects simultaneously the cerebellar peduncles and the nuclei of several cranial nerves. The only obscure feature of the case is the sensory dissociation on the opposite side of the body. Gowers' tract ascends in the medulla dispersed in the reticular substance in the formation of which participates also the median fillet. While the latter undergoes decussation, the majority of Gowers' fibres pass upward around the lateral lemniscus to the superior cerebellar peduncles.

The lesion in my case therefore pressed upon one of the cerebellar peduncles, affected the nuclei of several cranial nerves and involved the fibres conducting temperature and pain sense in the reticular formation.

As to the nature of the lesion, it is probably a *hæmorrhage,* which has been since considerably absorbed. There is no more evidence of involvement of cerebellar peduncle. At present the affection is confined to some difficulty of deglutition, to atrophy with RD and fibrillary tremor of the tongue, to paresthesia and syringomyelic sensory disturbance on the entire left side. The question of a specific lesion instead of a hæmorrhagic focus should be considered in spite of a negative syphilitic history, but the sudden onset with loss of consciousness is more in favor of effusion of blood in the

tissues than of a gumma which had developed slowly. The sensory disturbance in the present case is so characteristic of syringomyelia that the entire clinical picture, though bulbar in nature, seems analogous to that of spinal syringomyelia. Indeed we have here besides a sensory dissociation, signs, as well, of involvement of the cells of the nuclei of certain nerves (similar to that of cells of anterior cornua). If a hæmorrhage occurred (which is the most probable explanation), a cyst may have formed and become surrounded by proliferated neuroglia tissue, or a necrosis of the nervous tissue may have taken place and been followed by the formation of a cavity which had become surrounded by proliferated neuroglia tissue.

Minor, Patres, Sabrazès and others have reported a number of cases which show that a hæmorrhagic focus serves as a starting point for proliferation of the neuroglia tissue. A cavity is not absolutely necessary to produce the syringomyelic clinical picture.

Viewed from this standpoint the present case may be considered as a syringobulbia.

Some analogy can also be found in the present case with Brown-Séquard's paralysis, with this difference, however, that instead of being spinal, the lesion is in the bulb. Almost all the symptoms of the latter are found here, *viz.*, motor paralysis confined to cranial nerves on one side and sensory paralysis on the other. At all events a hæmorrhagic focus is apt to produce the clinical pictures of these various affections.

Otology

THIOSINAMINE IN THE TREATMENT OF DEAFNESS

BY M. LERMOYEZ, M.D.

of Paris

The countless number of people who are deaf can, in spite of their apparent similarity, be divided into three distinct groups which, although frequently combining with one another, have each their special characters: 1st, the labyrinth cases; 2d, the otosclerous cases; 3d, the otoadhesive cases.

A. The labyrinthic patients are perhaps the most numerous, arteriosclerous for the most part. These are the hæmatogenous deaf, the hypertensive, with whom the initial circulatory disorders of the internal ear remain unrecognized for a long period. They begin by having in the labyrinth the same trouble that they generally have in the heart: crises of intermittent claudication. Similar to an attack of angina pectoris, a sudden seizure of labyrinth ischæmia sends them tottering with sudden and violent vertigo. The stomach invariably gets the blame; it alone is treated. Other attacks occur at long intervals. But at the end arterial sclerosis settles definitely on the organs, and, in the labyrinth, produces incurable deafness.

The labyrinth case scarcely concerns the otologist, as local treatment is powerless. Like their weakening heart, or impermeable kidney, their ears require rest more than anything; and this is not obtained, precisely, by means of catheter passing and massage. This deafness belongs to the general therapeusis of arteriosclerosis; but even so, the treatment by means of iodide, Trunceck serum, and high-frequency currents, which is the only logical one, produces but little improvement.

B. The otosclerous patients receive from their parents, who are generally deaf, a congenital disorder which, for want of a better

term, we call otosclerosis. Treacherous deafness begins at puberty, increases with each pregnancy, and becomes definite in ripe years. In apposition to the labyrinth cases, which are generally old people, the present class consists mainly of young people, young women chiefly. At objective examination the ear appears normal; no more perfect tympanum, no freer tube, can be shown to a student. The lesion is a deep one, between the labyrinth and middle ear. It consists in osteitis of the bony capsule of the labyrinth, sending into the interior of the latter, hyperostoses that obstruct the foramina and stifle the terminations of the facial nerve.

No therapeutic action influences the evolution of this disease. Neither is general treatment efficacious: for phosphorus, the elective drug for bony tissue, proposed theoretically, has not kept its promises. Nor does the local treatment give any better result: for what action could the passing of a catheter through the tube have on osteitis of the labyrinth. It would even appear that energetic local treatment only makes the disorder worse, by inducing ear-noises before their hour. These otosclerous cases belong to the *noli me tangere* class.

C. The otoadhesive cases are less rebellious to treatment. Adhesive otitis is of a local nature, arising from the nose. The infection starts from the nose and carum, passes through the tubes, and attacks the middle ear alone, either suddenly, in the shape of acute suppurative otitis, or insidiously by means of recurring attacks of catarrh. The otorrhœa leaves adhesions behind it; the attacks of catarrh give rise to progressive hyperplastic otitis, which deforms the tympanum and fastens the ossicula together. Objective examination of such a case shows visible lesions of the middle ear, whereas for many years the labyrinth remains intact. The fibrous tissue forms a screen and partially intercepts the sound waves on their journey to the healthy auditive nerve.

In these cases local treatment comes into play; these are, as it were, the only deaf patients susceptible to treatment. With an easy conscience we can handle them indefinitely; to them we may be of some service.

Such, then, is a general classification of the deaf; schematic and artificial, very likely,—but true, a classification has to be schematic, to guide us through the chaos of the countless deaf.

The period during which every case of non-suppurating deafness was bundled into the category of otitis sicca and treated interminably by catheter-passing, to the greater profit to the physician than to the credit of our profession, has already lasted far too long. But this classification is not artificial. The three different types described above are absolutely distinct. That there are transitional, intermediary cases, no one pretends for one moment to contest; but nothing will be gained by taking them too closely into account. In a young natural science, such as otology, a lasting classification can only be established on the solid foundations of typical cases.

There are, then, three types of deaf patients: the labyrinth cases, belonging to the physician; the otoadhesives, to the aurist; the otosclerous, whom nobody wants.

And yet, although the otoadhesives fall manifestly under the indications of local treatment, they have not benefited much by it. Intra-tympanic treatment, which by means of ingenious interventions, endeavors to cut or remove the fibrous adhesions that hinder audition, has almost always failed; and the bands and adhesions reappear more resistant than ever. The results are better if we content ourselves with limbering up adhesions, loosening them by massage, the catheter, etc., so as to lessen the rigidity of the screen intercepting sound waves; but the benefit derived is only temporary.

But we are now in possession of a new remedy for the otoadhesives, thiosinamine, which appears to be full of promise.

Thiosinamine is an allyl-sulphocarbamide, obtained by the action of ammonia on essence of mustard. Its taste is bitter, and its use is not irritating. Its crystals, white, brilliant, dissolve very badly in cold water, better in hot, and very well in cold alcohol. This almost total insolubility in cold water hindered for a long time its use in therapeutics; at the outset nothing but the alcoholic solution could be used, and this was inefficacious by the mouth, and very painful in hypodermic injections.

In 1905 F. Mendel succeeded in dissolving thiosinamine by the addition of another substance forming with it a double salt. This was named fibrolysine, which, prepared by Merck, contains one molecule of thiosinamine for half a molecule of sodium sali-

cylate. It dissolves readily in water in the proportion of 15 per cent.

A solution of German fibrolysine has the drawback of rapidly decomposing in contact with air or light; when poured out of the sterilized bulbs of yellow glass in which it comes, it soon smells of garlic, a sign of alteration. Besides, it crystallizes with such rapidity that it often obstructs the needles used for injecting it.

Michel, of Paris, has improved the dissolving of thiosinamine. He observed that among the different substances that form its solution in cold water, antipyrine is the best. Half a molecule of antipyrine, combined with a molecule of thiosinamine, form a syrupy liquid at the ordinary temperature. This liquid has no color or smell, and is more soluble in water than fibrolysine,—one to three. This combination has, furthermore, the advantage over the German product, of not being affected by air or white light.

I use a 15 per cent. solution, which is neither irritating nor painful:

Thiosinamine	15.
Antipyrine	7.½
Distilled water	100.

The specific property of thiosinamine is to soften cicatricial tissue, and this curious action even takes place at a distance; a hypodermic injection will relieve urethral stricture.

This elective action of thiosinamine for cicatricial tissue has been well explained by Glas. It brings about œdema of a cicatrix. Thus in a case of fibrous stenosis of the larynx, produced by syphilis and causing the patient no particular discomfort, four injections of thiosinamine produced such swelling of the sclerous tissue that tracheotomy had to be performed as a matter of urgency.

Histologically, scars treated by this solution lose their normal appearance. Their limits become uncertain, and it is difficult to distinguish them from the neighboring connective tissue. The nuclei appear wide apart; the fibres are swollen and dissociated.

The action of thiosinamine is comparable to the venous stasis of Bier's method; there is interstitial œdema and softening. This production of lymph does not take place in healthy tissue, if the therapeutic dose is not exceeded. In toxic doses, thiosinamine

produces permanent anasarca in the frog. Beside this, this drug is said to give rise, four hours after administration, to very marked leucocytosis; attracted by a species of positive chemiotaxis, the excess of leucocytes flows towards the scars and acts as phagocytes as regards the connective tissue.

Thiosinamine softens scar tissue but does not destroy it. Its effect is rapid, and can often be already perceived after four hours' time; but on the other hand it is temporary, the benefit acquired disappearing a few days after cessation of treatment. Thiosinamine is therefore an adjuvant to mechanical treatment, which must always follow it, to stretch the scars permanently when they have first been softened. By associating these two therapeutic elements lasting recoveries can be obtained.

Thiosinamine is a harmless remedy, and is not toxic; it has been given subcutaneously two or three times a week for over a year, without producing anything beyond temporary impairment of appetite and strength. The injections of the aqueous solution are much less painful than those of the alcoholic.

There are, however, some drawbacks to the hypodermic use of this substance, which need only be mentioned, as for our present purpose the drug is not used subcutaneously.

When given in injection, thiosinamine acts not only on the scar you propose to treat, but on *any other* the patient may possess! It is well, therefore, not to use this mode of administration with *former tubercular* patients, for instance.

It was von Hebra who introduced this drug into therapeutics, his first researches having been presented at the dermatological congress in Vienna in 1892. It was then employed by a variety of authors for different purposes, and five years ago the idea occurred to me to try it in adhesions of the middle ear after otorrhœa and for the purpose of lessening the deafness and noises caused thereby.

Twelve patients were put under treatment at St. Antoine Hospital. The cases were not selected ones, as nowadays; there were as many sclerous as adhesive ones. Each one was treated with a series of injections of one-half to one c.c. of an alcoholic solution of thiosinamine, 15 per cent. Half of the patients were treated locally as well; the rest were left to the thiosinamine alone. The

results were entirely negative, and our experiments ended there, for the time being. Other operators, however, were more fortunate, but they combined the injections with massage of the tympanum and catheterizing the tube.

Sugar carried the question forward a degree in 1905 by using the drug solely in adhesive cases, and excluding sclerous cases altogether. In addition to the subcutaneous injections he introduced into the middle ear through the tube a 10 per cent. glycerine solution of thiosinamine, which is blander than the alcoholic one. His results were encouraging.

In 1906 I resumed my attempts, which had been interrupted since 1902, and taking advantage of the information that had accumulated in the interval I was careful, first to treat only purely adhesive cases, cicatricial or catarrhal; second, to use the thiosinamine locally, either through the tube or through the external ear passage; third, to combine systematically with it massage of the tympanum. This time I was more fortunate. Eight adhesive cases derived a certain amount of benefit from the treatment; unfortunately with two of them the otorrhœa reappeared, induced by the irritating action of the alcohol. This accident has been done away with, now that we use the aqueous solution of Michel.

The technique of the thiosinamine treatment of deafness is extremely simple, and within the reach of any practitioner. The patient takes every day, preferably at night time, an ear bath of five minutes' duration with a warm solution of antipyrine-thiosinamine. Twice a week he sees his physician for pneumatic massage of the tympanum.

As a general rule the hearing improves distinctly in two weeks' time. This improvement is remarkable in cicatricial adhesive conditions resulting from former otorrhœa, where a large tympanic perforation enables the liquid to enter the middle ear. It is naturally less marked in adhesive otitis following long-standing tubotympanic catarrh, when the tympanum is not perforated; nevertheless I have noticed that even in these cases the thiosinamine acts. It seems as though it is able to filter through the tympanum and soften up the bands in the middle ear.

When this process fails,—and only then,—I use injections through the tube. This method, more difficult, and probably less

harmless, makes it necessary that the patient should be under closer supervision; on the other hand it appears more efficacious than the simple bath of the external passage.

But injections of thiosinamine through the eustachian tube are quite useless when, first, the tympanum is perforated; second, when the tympanum adheres so closely to the back wall of the middle ear that not a drop of the solution can be made to enter into the internal cavity of the middle ear. In the latter case the passing of bougies, and rarification in the external passage, must be carried out with perseverance; so soon as it is perceived that the tympanum is beginning to adhere less closely to the inner wall, the injections through the tube can be commenced.

This method is harmless, and at the most produces nothing more than slight injection of the tympanum, provided, first, that the solution used is strictly sterilized; second, that only two or three drops are injected at a time.

It is evident that the thiosinamine cure can only give a lasting result when combined with mechanical treatment; and when the patient is sufficiently skilful to masser the tympanum himself after each bath, the improvement obtained is more rapid still.

When the thiosinamine cure fails it does so for two main reasons: First, through faults in technique; second, through mistaken diagnosis.

At the present time at least the indications for this treatment appear to be clear, but still very restricted.

The only form of deafness likely to be benefited by the thiosinamine treatment is that due to adhesive otitis, whether caused by former suppuration or by non-suppurative catarrh. Labyrinth and sclerous cases are to be systematically set aside.

And among the adhesive cases not all are likely to improve under the thiosinamine, indiscriminately; we must, even in this group, make a careful selection and eliminate many, refuse those with whom the labyrinth is inadequate, as well as those with whom the stapes has lost all mobility.

This leaves a final group amenable to the thiosinamine treatment, the adhesive cases of deafness in which the Rinne test is negative and the Gellé positive, and where sound-conduction through the bones is still satisfactory, as shown by a non-shortened Schwa-

bach test. With such cases as these there is almost always a chance of succeeding; and this hope is greater in adhesive otitis due to suppuration, where a large perforation enables the active solution to penetrate directly into the middle ear, than in adhesive otitis of catarrhal origin, where the remedy can only reach the adhesions by passing through the tympanum or tube, often an uncertain matter.

Special care must be taken to be on our guard against psychical deafness, which so often renders a diagnosis difficult for an orthodox aurist, and facilitates the ventures of the other members of the fraternity.

The psychic deaf, although suffering from local disorders, are above all victims to deafness-phobia, and often puzzle the aurist at the beginning. Their anxious behavior, their distress at not being able to hear during the acoumetric tests, as well as the frequently remarkable discordance between the data furnished by objective examination and the hearing tests, betray them beyond peradventure. With them the slightest therapeutic intervention, presented with boldness and accepted with confidence, becomes a pretext for recovery. Boulay has restored the hearing of psycho-deaf patients by painting the external ear passage with menthol! In this way we might be led into error as regards the action of thiosinamine if we were not on the lookout; it would then act mainly by the words in which the directions were couched. In the psycho-deaf the manner of giving is of greater importance than the gift itself!

As an instance I may cite one of my cases, a nervous, unbalanced patient, who one day grafted an outbreak of psychical deafness on his long-standing catarrh of the tubes. About that time I attempted to cheer up his condition of despair by speaking to him of thiosinamine as a treatment that he had not yet tried. Eight baths of the left ear increased his hearing tenfold on that side. This was very satisfactory. But what was still more so, was to find that the other ear, which had not been touched, had improved to an equal extent!

But supposing all these causes of error eliminated, here is what can be expected from thiosinamine. Among our case histories I will mention three different types.

1. *Adhesive Otitis, Caused by Former Otorrhœa.*—Tympanum

atrophied, perforated, adherent to the posterior wall; malleus moveable. Thiosinamine bath every day, with massage. Results: after the fifteenth bath the head-noises disappeared; watch-range increased from 12 to 40 cm. This improvement persisted five months later.

2. *Adhesive Otitis, Due to Recurring Tubo-tympanic Catarrh.*—Drums driven in, mallei fastened to posterior walls and motionless. Twenty-five thiosinamine baths in the right ear and several instillations by the tube. Results: Disappearance of head-sounds: watch-range increased from 1 to 25 cm.; and the improvement lasted. During this time the left ear, kept as a witness, did not change in hearing power.

3. *Adhesive Otitis, Due to Facial Erysipelas That Had Spread to the Ear.*—Six thiosinamine baths tripled the hearing power, and ten more, followed by massage, carried it to six times its former range, and this improvement lasted.

It is an error to believe that the improvement in hearing produced by the thiosinamine is due to the mechanical treatment into which it is combined; for in all the cases published these manœuvres had first been employed without results. Neither thiosinamine nor massage, used by themselves, give any lasting effect; their association together is imperative.

Are we then to hope that we are now in possession of means for making certain cases of deafness hear? In such matters as these it is prudent to suspend judgment. So many treatments for deafness have seen decadence prematurely follow their period of grandeur, that we can no longer unreservedly accept a new one. Still, it would seem as if thiosinamine, which has now been known for fifteen years, has not disappointed its promises, and that we aurists are justified in thinking that it is destined to be of some help to us.

The main thing is to refrain from applying the method to all cases of deafness. This would very promptly bring it into discredit. Thiosinamine will be lost, so far as we are concerned, from the day that it becomes the infallible cure for deafness!

Let us steer clear of the easy and instantaneous method of classifying all old cases of deafness in the category of otitis sicca. Let us, for the time being, at least, choose our cases: *adhesive otitis, with a good labyrinth and movable stapes.* It may be that, later on, our

successes will authorize us to extend the thiosinamine indications to more risky ventures.

Those only who will follow this prudent course will be the good pilots, capable of guiding with safe hand the thiosinamine method past the two dangers that so often befall a new treatment: the lucrative bursts of therapeutic enthusiasm, and the disdain of barren scepticism.

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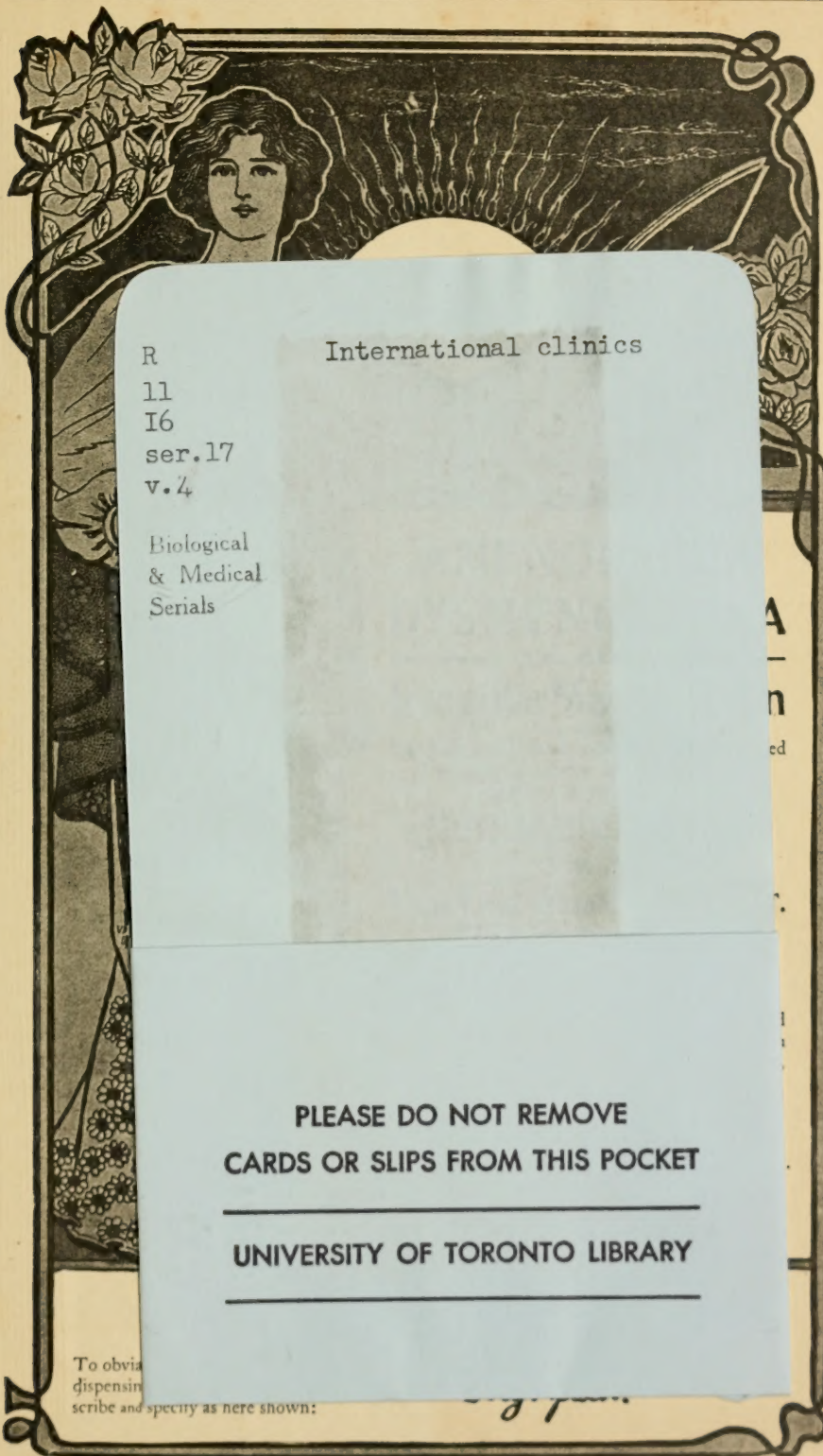

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